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The MODEL ENGINEER

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SMOKE RINGS

Our Cover Picture

● MOTOR RACING is fast becoming a leading spectacle in Britain. More and more of the public are appreciating the finer points of the design and construction of Grand Prix cars, and the day is fast approaching when they will be as popular subjects for the model engineers' art as the traction engine and locomotive of yesteryear.

In selecting a racing car as the subject for the cover of this issue, we hope to be able to convey to our readers some idea of the terrific strides that have been taken in this branch of model engineering during the past twelve months. The splendid workmanship and skilful depiction of detail are surely hallmarks of the eligibility of this model to hold the honoured position, and those of you who are fortunate enough to witness the demonstrations of Mr. Rex Hays at the "M.E." Exhibition will agree that there is really more to miniature automobile engineering than meets the eye. By this we do not mean to imply that it is difficult, but rather, immensely fascinating.

The model on the cover is of Dr. Farina's famous 158 Alfa Romeo which won the Grand Prix d'Europe at Silverstone on May 13th this year, and was constructed by Mr. Rex Hays for Motor Racing Publications Ltd., to whom we are indebted for permission to obtain a most excellent series of photographs.

An effort was made to secure the loan of this and other models of similar quality for display at the Exhibition, but unfortunately, they had already been loaned to *The Daily Express* for publicity purposes. They are most effectively displayed, incidentally, and all readers who are at all interested are assured that it would be well worth their while, should they be in the neighbourhood of Fleet Street any time between now and August 24th, to avail themselves of this opportunity for a close inspection.

Finally, it will have been noticed that colour has been used and this, it is hoped, will lend a degree of realism. It will be appreciated, however, that it is extremely difficult to guarantee a perfect Alfa Red, and for this reason modellers are advised to carry out further investigations rather than copy the shade employed on this issue.

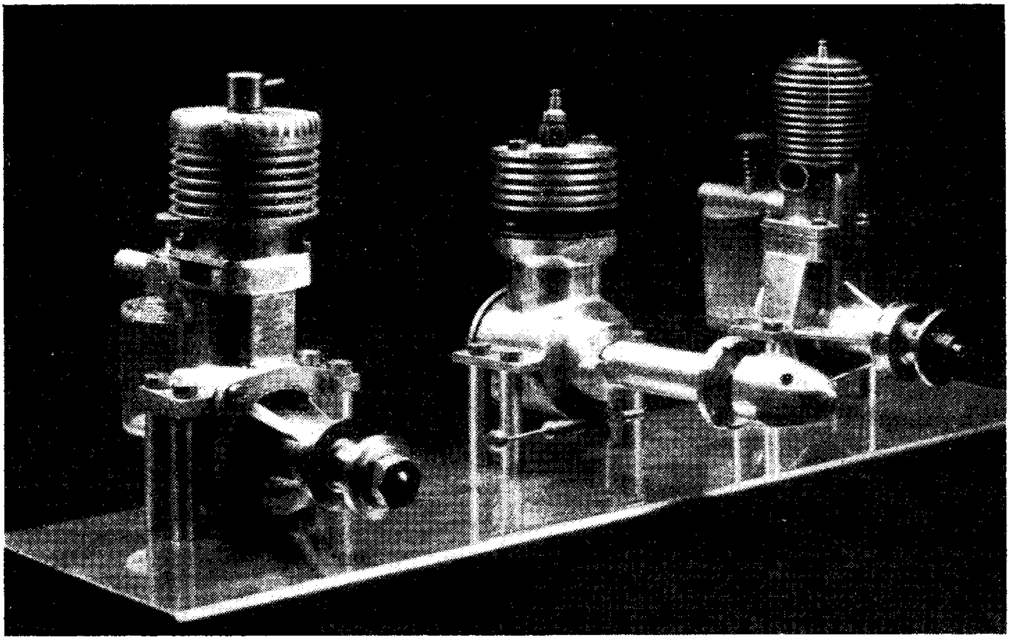
The "M.E." Exhibition

● BY THE time this note appears, the "M.E." Exhibition will be upon us and we anticipate that we shall be in the throes of judging the models, meeting and chatting with friends and acquaintances, past and present, and, we hope, making new acquaintances. It is the climax of a busy time for us, and throughout many preceding weeks we have, of course, been making strenuous preparations to ensure that normal editorial work shall not be disturbed. THE MODEL ENGINEER must be got out on time, each week, exhibition or no exhibition, and our monthlies, also, demand all the usual and regular preparation, unhindered by stress of extra calls upon our editorial time.

But to our readers, who are not concerned with what goes on behind the editorial scenes, the exhibition is approached in a very different way. Many of them regard it as one of the highlights in the model engineering calendar, an event not to be missed at any price, and the New Horticultural Hall becomes a Mecca for model engineers from all over the British Isles. For the exhibition is generally thought to contain the "cream" of the hobby's production, and we believe this idea to be justified.

This year, as usual, the marine section of the exhibition is, by far, the strongest. Our ship-lover friends have brought reproduction in miniature literally to a fine art; for there can be no question that, in this section, the general quality of the work is of the very best. Moreover, the lure of the historical and old-time prototype is most clearly evident in the ship models, and it unfailingly produces results which give expression to all that is understood by the word craftsmanship.

But it is, perhaps, as a social event that the "M.E." Exhibition is so popular. Here, for a brief spell, the model engineer can forget the anxieties of life and enjoy himself in meeting kindred spirits, professional and amateur, seeing and admiring or criticising the exhibits and discussing his likes and dislikes with everyone. In short, the general atmosphere is one of freedom and friendliness which, once experienced, becomes an indelible and cherished memory.



"Life Begins at 40"

● THE PHOTOGRAPH reproduced on this page, while it undoubtedly shows some excellent work, has a most illuminating story behind it. It was one of a number sent in by Mr. J. B. Stewart, of Salisbury, who states: "The photograph shows my exhibit at our model engineering exhibition. The engines are my home-built Wildcat, Buzzard and, in the centre, my own design 2.7 c.c. About eighteen months ago, I decided to take up model engineering as a change and in addition to aeromodelling. At that time, I had no idea what 'headstock' or 'tailstock' meant; in fact, I knew nothing about a lathe and very little of engineering practice. And so, by placing a standing order for the 'M.E.', attending club meetings and asking thousands of questions, my interest was really stimulated. I am 40 years of age and have realised the truth of the saying that 'Life begins at 40'."

We would add a reminder that "it is never too late to learn." A combination of the two sayings can, as in Mr. Stewart's case, produce some thoroughly satisfying results.

Attractions and Features

at the Model Engineer Exhibition

ONE of the chief attractions, after the competition models and trade stands, is the Central Demonstration Area where experts and club members are giving demonstrations of different kinds of workshop processes and model construction.

The Society of Model and Experimental Engineers, members of which, by the way, are responsible for operating the passenger-carrying track, are also demonstrating practical engineering work which can be accomplished with the simplest of tools.

A rather novel feature is provided by the George Kent Model Engineering Society in a demonstration of various forms of glass working.

Hydroplane construction by Mr. F. C. Walton, wood-turning on an up-to-date lathe and a bodger's lathe by Messrs. F. Pain and W. Ridgeley should be attractive to many visitors.

Messrs. Dick Simmonds & Co. have kindly consented to show how boilers for miniature steam locomotives are made.

A representative of Z. N. Motors Ltd. is displaying the gentle [?] art of body-bashing; i.e., the forming of the bodywork for model cars. The model car interest, however, is further provided for by a display of the methods of super-detail model car construction by Mr. Rex Hays who needs no introduction to our readers.

" Duplex "

The regular series of articles in THE MODEL ENGINEER by this team of contributors has been the subject of much complimentary comment among readers, and last year's display of the many workshop accessories which have been actually constructed and described by them was a very popular centre of interest. The display has been further augmented and brought up to date for this year's exhibition, and the contributors are present in person to demonstrate the use of the many devices, or to give advice on any matters appertaining to the home workshop.

At work in the forge

The Forge at Work. J. A. Ibbotson, Walton Forge, near Tadworth, Surrey.

Under modern industrial conditions, hand forging, which has played so important a part in the building of civilisation in this country and throughout the world, is in danger of becoming a lost art. Model engineers, and indeed amateur and professional craftsmen of all kinds, will undoubtedly welcome these demonstrations of blacksmith's work, which are given by Mr. Ibbotson and his staff every day of the Exhibition. From 2 p.m. to 3 p.m., and 6 p.m. to 7 p.m., a special programme of demonstrations has been arranged and includes toolmaking, the use of bending and setting tools, working corners, sweeps and bends, forge welding, combined forge and oxy-acetylene blowpipe technique, and ornamental ironwork, including scroll making, leaf work and gate making.

The demonstrators are practical blacksmiths, who carry out their ancient craft at the Forge at Walton-on-the-Hill, near Tadworth, near the site where the original forge stood for hundreds of years, but the present building was rebuilt on modern lines about 1930. Here one may still see the traditional work of the country blacksmith carried on daily, but the march of progress has not been ignored, and the workshop is equipped with welding plant and other machinery to cope with modern problems. The present owner of the forge comes from a long line of blacksmiths, dating from the time the Huguenots settled in this country in the 17th century bringing their arts and crafts with them. The hand-

forged products of the Walton forge are in great demand, both in this country and abroad.

The " M.E. " Workshop

Many of the up-to-date types of models, tools and workshop accessories which are described from time to time in THE MODEL ENGINEER have either been built and developed in the " M.E." workshop, or have been the direct or indirect outcome of experimental work which is constantly in progress therein. Readers have often expressed an interest in the activities behind the scenes of THE MODEL ENGINEER, and a glimpse of them is given in this display, in which the essential equipment of the workshop has been transplanted to the stand, and is being demonstrated in action by members of the staff.

In order to keep in proper contact with the conditions under which most of our readers work, including limitations in equipment and facilities, the workshop contains no highly elaborate machine tools, or appliances of any kind which would be beyond the resources of the average model engineer. The work that is done in the " M.E." workshop is such that can be carried out efficiently in the normally equipped workshop by exercise of care and patience, as already proved by the results obtained by readers who have worked to " M.E." designs and instructions.

Royal Air Force

The main attraction on this stand is a fully detailed scale model of a Gloster Meteor fighter. Many R.A.F. Fighter Squadrons are at present equipped with this 600 m.p.h. aircraft, which is fitted with two Rolls-Royce Derwent jet engines.

The R.A.F. are at present endeavouring to interest lads of 15-17½ years in their training scheme for ground technicians which provides an opportunity for training R.A.F. apprentices to fill senior technicians' posts. Full details are available on this stand.

Finally, a stand entitled " Models in Industry " illustrates some of the uses to which models are applied in the commercial world.

Clubs and Societies

at the Exhibition

The Model Railway Club. When this club was founded 40 years ago, most of the model railway components and accessories available were little better than toys, and a primary objective of the club was to secure the co-operation of all those interested in this type of model with a view to improving the standards of design and craftsmanship ; an objective which has already had very fruitful results, but is still pursued vigorously by the present membership, now more than 350 strong.

In addition to regular fortnightly meetings throughout the year, except during August, the club produces its own quarterly journal, arranges visits to places of railway interest during the summer, and owns a passenger-carrying track which is used at the club's annual Easter exhibition.

The Model Yachting Association. A special feature of this year's M.Y.A. stand is the " A " Class yacht which won the Championship Cup in July. Also, of particular interest to those contemplating building a yacht, is a partly constructed model, showing the method of construction and the tools employed. The display also includes several other finished models of various classes.

The Hammersmith Ship Model Society. This society, which was restarted in April of last year, has a varied selection of ship models on its stand, including the ever-fascinating ships in bottles, some cannon, sailing yachts, and a model of an air-sea rescue launch equipped with radio control. Of particular interest is a group of junks, constructed for pond sailing.

The Model Power Boat Association. Over 40 affiliated clubs throughout Great Britain are now represented by this Association, which was formed in 1924 for the control of inter-club activities and competitions for all classes of model power boats. During the period of its existence, considerable progress has been made in the design of both prototype and racing boats, and a consistent improvement in the speed of the latter, in all sizes and types, has been and still is being maintained. In addition to regattas held on the home waters of several of the most important clubs, two special regattas are held annually at Victoria Park, London, E., namely the International (for racing craft only) and the Grand (for all types of craft) ; the latter being invariably held on the Sunday following the " M.E." Exhibition, for the benefit of visitors from the provinces or elsewhere, who may be in London for this occasion.

The Association of Ship Model Societies. There are nearly 40 independent ship model societies in the British Isles, and some examples of the work being carried out by their members can be seen here and on the competition stands.

The societies cater for all people interested in models of ships, from the man who wants to make a decorative model of a galleon to the man who is an advanced research worker in nautical archaeology, and this year, for the first time, the stand has been organised by the newly formed Association of Ship Model Societies, which was instituted to link the societies closer together, and to provide for them the same services which they provide for their individual members.

There are continuous demonstrations of methods

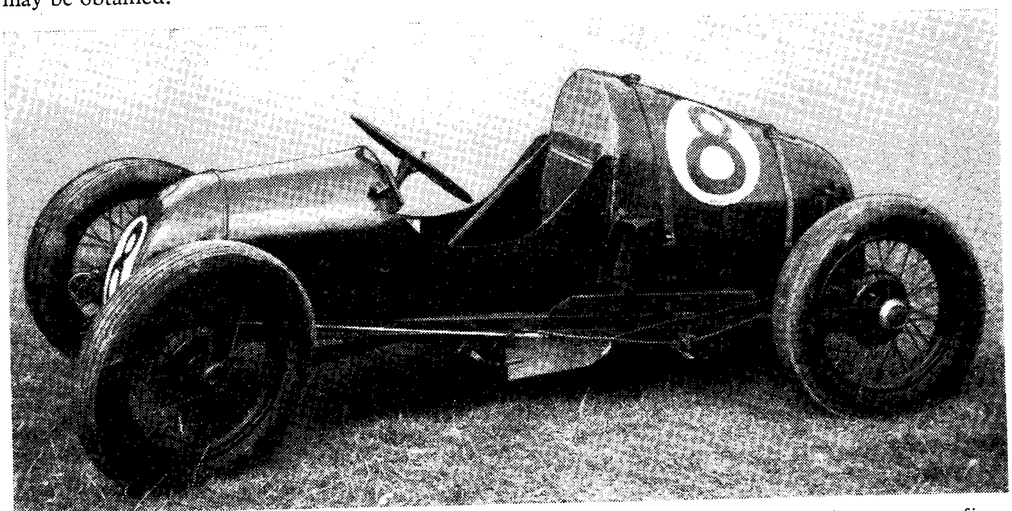
of construction to be seen on the demonstration stand in the centre of the hall, and anyone who is interested in ships, or models of ships, will find a welcome at the association's stand, where further examples and demonstrations of model making are available and any required information may be obtained.

The 500 Club. Making its first appearance at a MODEL ENGINEER Exhibition, the 500 Club stand affords the opportunity which so many model engineers have sought in vain—to really get the "gen" on these fascinating little 100 m.p.h. plus racing cars.

Frank Bacon's clever adaptation of an ancient Austin Seven chassis is ample proof of what can be done in the average workshop without elaborate equipment. One of the earliest competitors in 500 c.c. events, Frank typifies the spirit of the movement, and even today, when a number of newer and faster cars are lined up on the starting grid beside him, he is confident that this home-made baby will hold its own with some of the best and, most important, afford him his fair share of fun.

The Kieft, one of the latest developments in the 500 Class, shows how the movement has progressed and how, from the earlier designs of suspension and brakes, have evolved the very latest and most up-to-date practices in automobile engineering.

Other interesting features include a complete story, in picture form, of the construction of a 500-c.c. racing car, a full set of the international code flags used in motor racing, plans of the leading British and Continental circuits on which these cars have raced, and literature which will enable the tyro to gain first-class knowledge on what makes the movement tick.



The F.G.B. Special, Frank Bacon's Austin Seven-based home-built racer, powered by a 500-c.c. five-stud J.A.P. motorcycle engine

The Society of Model Aeronautical Engineers Ltd. This society is the body delegated by the Royal Aero Club to control international and national contests in this country; they also ratify official British model aircraft records.

The S.M.A.E. has some 500 affiliated clubs in all parts of the country, including 100 Royal Air Force clubs which are officially sponsored by the Air Ministry.

All types of model aircraft will be displayed on their stand, including a number of record-holding models and winners of international contests.

In the demonstration area members of S.M.A.E. affiliated clubs may be seen constructing model aircraft.

Low Speed Aerodynamics Research Association. The L.S.A.R.A. is an organisation devoted to research work on model aircraft.

The major exhibit on their stand is a multi-channel radio control set, designed to meet the requirements of meteorological research, A.A. gunnery training, and for scale model free-flight research by the aircraft industry. The aircraft demonstrated can be made to loop, dive, roll and spin in obedience to the movements on the control column and rudder bar at the ground station, and in addition it carries automatic devices to maintain a given altitude and heading as commanded by the pilot on the ground. Various components of the system are also displayed separately.

A full selection of L.S.A.R.A. reports is available to the public, and technical experts are in attendance on the stand to demonstrate equipment and answer queries.

International Radio Controlled Models Society (London Group). In view of the rapidly increasing interest in the development of radio control of working models, this society was formed in 1947 to bring together all those interested in this branch of experimental work, and to co-ordinate and interchange available knowledge on the subject. The latter object is promoted by the publication of bulletins, supplemented by pamphlets giving technical information on the latest experiments, which are distributed

regularly to members, and there is a prospect of publishing, in the near future, more frequent and topical reports of activities and technical data.

The radio-controlled D.U.K.W. amphibious vehicle which was such a success at last year's Exhibition is again being demonstrated. This model is unique in many respects and represents the practical results of considerable research work on the most modern principles of radio control. It works on the authorised short-wave band and employs five modulation frequencies to give proportional steering, speed control, and auxiliary functions such as operating the horn and winch. Other models and components, some still in the experimental stage, are on view. The society members include the first, second, third and fourth place winners in a recent radio control competition.

Sutton Model Engineering Club. This club has been in existence now for 15 years, and with a present membership of nearly 80 members, is now one of the most active clubs on the southern outskirts of the Metropolitan area. Many of the founder members of the club still remain, and all branches of model and experimental work are encouraged, the only qualifications for membership being interest and enthusiasm in mechanical craftsmanship. The club owns an acre of freehold ground at Chatham Close, Sutton Common Road, where two multi-gauge locomotive tracks are erected, one being a straight track of 130 ft. for testing purposes, and the other a continuous track of 518 ft., in a natural scenic setting. In addition, a portable track is available, and is continuously in demand for use at charity fetes and other functions. Active preparations have now been made for building a clubhouse on the above grounds and will be proceeded with as funds permit.

South London Model Engineering Society. The activities of model engineers, in all branches of model work, in and around South London and its environs are catered for by this society, which was founded in its present form during the war, and incorporates the pre-war South London Model Power Boat Club. Regular meetings are held on alternate Sunday mornings at King's College Sports Ground, Dog Kennel Hill, East Dulwich, and every Tuesday evening at the Beaufoy Technical Institute, Kennington, where workshop facilities are available to members. In addition, the pond at Brockwell Park, Herne Hill, is available for trying out model power boats and holding regattas. The society also owns and operates a multiple-gauge model railway track, which is extensively employed throughout the year at charity fetes and garden parties.

The Ilford and West Essex Model Railway Club intend to display some of the latest and best of their ever-fascinating miniature railway work which has, hitherto, managed to hold its own easily against the best of this kind of work.

The Light Railway Transport League are exhibiting a 7-mm. scale model tramway layout which illustrates the modern conception of a private track express tramway system on a principle which the League advocates for certain tramway routes in the Metropolis. In addition, there is on show a $\frac{3}{4}$-in. scale model of a modern Aberdeen streamlined car, contrasted with a model, in the same scale, of a standard London Transport car of the E/1 type.

The British Puppet and Model Theatre Guild is an ever-popular attraction with its puppets, miniature stage, scenery, etc., which we are glad to welcome once again to the "M.E." Exhibition.

Models on Loan

IN writing last week of the ship models to be seen at the Exhibition, we made no mention of those in the Loan Section.

With regard to the clipper *Thermopylae*, to which reference was made in our previous article, this is now included in the Loan Section, owing to its stripped-down condition.

Another notable model in this section is also a sailing model clipper, and curiously enough, is of *Thermopylae's* great contemporary and rival the *Cutty Sark*. This is to an even larger scale than the *Thermopylae*, being 1/3 in. to 1 ft. and giving a model 63 in. long on the waterline and about 7 ft. long overall. It is loaned by Mr. J. T. Brittain, of Chelsea, who often sails it on the Round Pond at Kensington. We would be interested to learn how Mr. Brittain transports it to its sailing water. Judging from the photographs we have seen, it contains a wealth of detail, both in the hull and the rigging. We hope to see it sailing in the near future and will try to get some photographs of it, preferably in a good breeze, for publication in our companion magazine, *Model Ships and Power Boats.*

There is yet another sailing square rigger in the Loan Section, also of a famous clipper, the *Caliph*. This is a smaller model, built and sailed by a youth, Mr. C. L. Robinson, who is still at school, of the Sheffield Ship Model Society, but who nevertheless finds time to write us very interesting and intriguing letters about his sailing experiences. This model was not entered in the Competition Section, as it has seen much hard sailing and has lost some of its pristine freshness.

Mr. Charles Hampshire, M.I.M.E., F.R.S.A., is one of the judges for ship models and thus cannot enter for competition. He has, however, loaned his model of H.M.S. *Greyhound*, to the scale of 1/64 in. to 1 ft. This model was on view in 1940 at the Admiralty, and later was shown at the offices of Percival Marshall & Co. Ltd., in Kingsway. It was on the premises when they were destroyed during the bombing, but was found later undamaged. Evidently a small model has certain advantages. Mr. Hampshire's models are known all over the world, and we are fortunate in being able to exhibit a specimen of his work.

A Remote-Controlled Model Trolley Bus

by B. W. Francis

THE remote-control toy is now very popular, and I thought I would try making one for my son. Having considered various vehicles I came to the conclusion a trolley bus would be a good model to make, and so some photographs of these vehicles were found in commercial vehicle magazines.

I wanted the model to be small and yet able to house a M/C battery, so the model was really built round this.

My usual method in building models is to work out all dimensions from the wheel diameter, and in this case it worked out to be approximately 2 in. The best way to start is, I think, to draw out side view, plan, front and rear views full size, then all measurements can be taken from the drawings direct. I always make the bodies of models first, and then fit the motive power and details afterwards, of course, making sure beforehand that there is enough room to contain them. The body of this model was constructed in the following way, all made out of 24-g. sheet tin.

The sides, front and rear were drawn out on the tin, only the outlines at this stage, no window details as yet. As the edges are rounded it follows that the dimensions for these parts will not be quite as they appear from drawings, but if all measurements are taken from these, the right sizes can be ascertained. By rounding the edges the shape takes a "short cut," and the individual pieces will be smaller than appears from just one view of the plan.

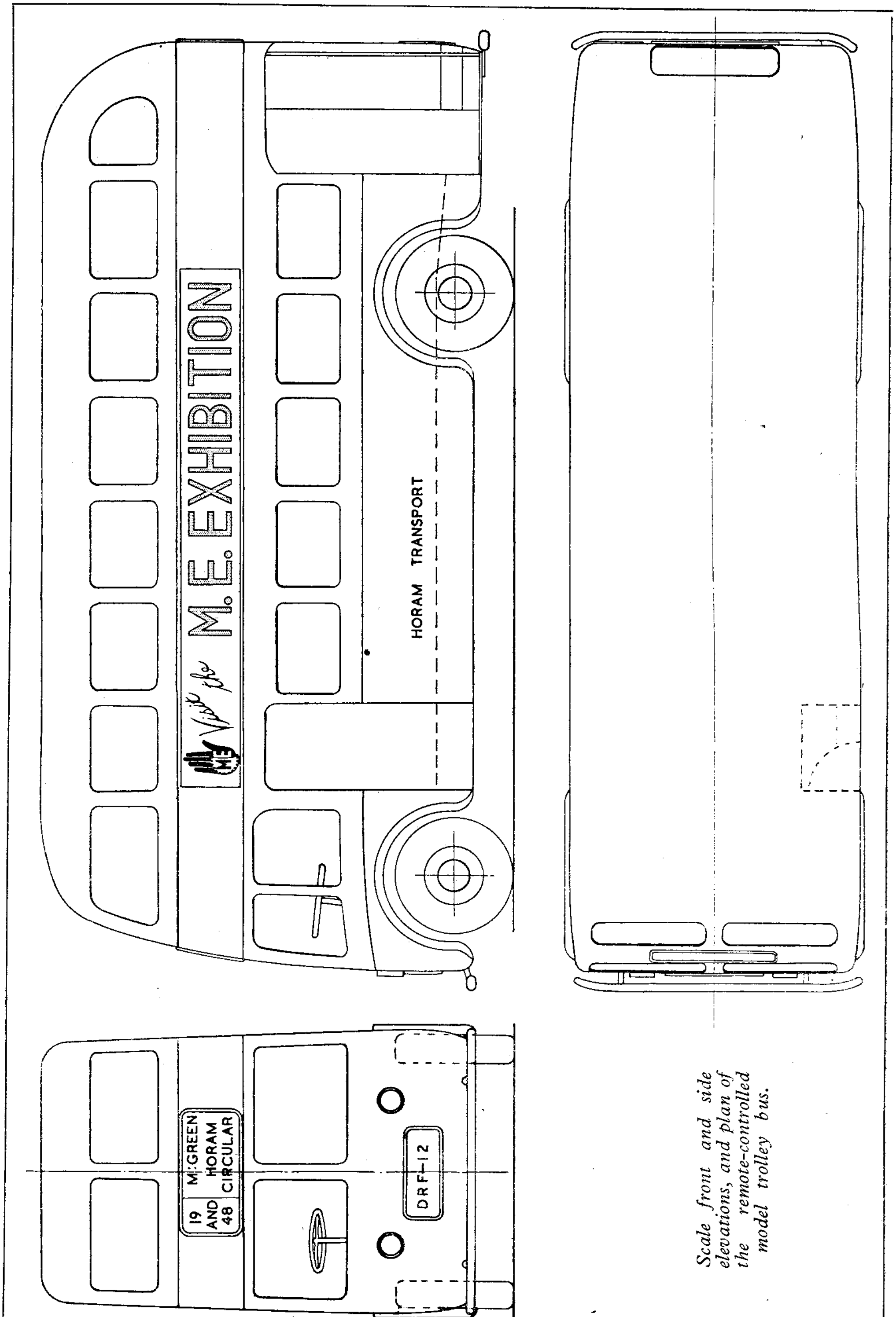
Regarding the roof, when making all the pieces it must be remembered that the top of these form part of it and bend round until it straightens out for the flat top. If the scale mentioned is followed, there is just enough room for the M/C battery to slip down through (width only $3\frac{1}{2}$ in.). When the pieces have been cut and bent so that they meet fairly well, the next most important operation of fixing them is due. If this is not done correctly the model will be spoilt, because it will not be "square" from all angles.

The two sides are "tacked" with solder to the front first, then the rear done last; this is because the rear entrance has been cut out, so the near side corner is missing. To strengthen and also to allow for filing any bad joints, a strip of tin about $\frac{1}{4}$ in. wide is soldered down the seams inside the model. If these directions are followed it will be found the model is very rigid and "square" for all time.

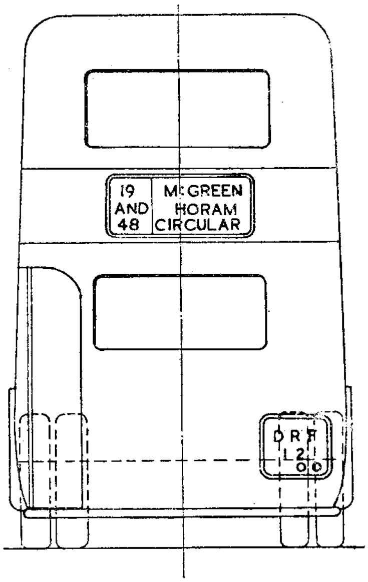
The model and its "driver"

The next job is to mark out windows and entrances. To cut these I drilled a $\frac{1}{4}$ in. hole in the corner of each window, then cut out the rest with a small chisel. For an anvil I used a piece of 2 in. $\times$ $\frac{1}{4}$-in. angle-iron gripped in the vice. The rough edges were trimmed up with a small file. To add strength and also improve the appearance the edges were bent over at an angle of about 45 deg., the bend being just under $\frac{1}{8}$ in. When cutting doors an allowance must be made to bend over these edges to make clean and strong edges. The front edge of the driver's door is rolled over a piece of $\frac{1}{16}$-in. wire to make a hinge. Mudguard arches can then be cut out.

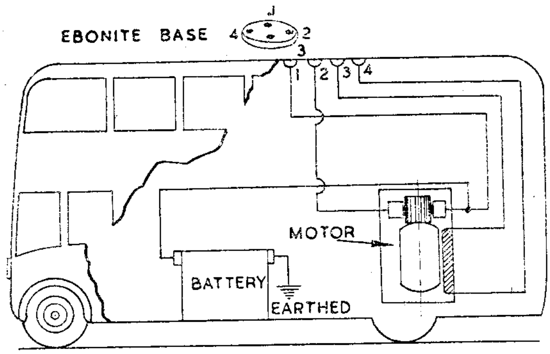
The bottom floor is the next part to make, remembering this is on three levels; front compartment, passenger part and rear platform; therefore, the extra length required must be allowed for. Draw out the gaps necessary for the wheel arches, allowing enough for the steering front wheels, but do not cut out completely, as part



Scale front and side elevations, and plan of the remote-controlled model trolley bus.



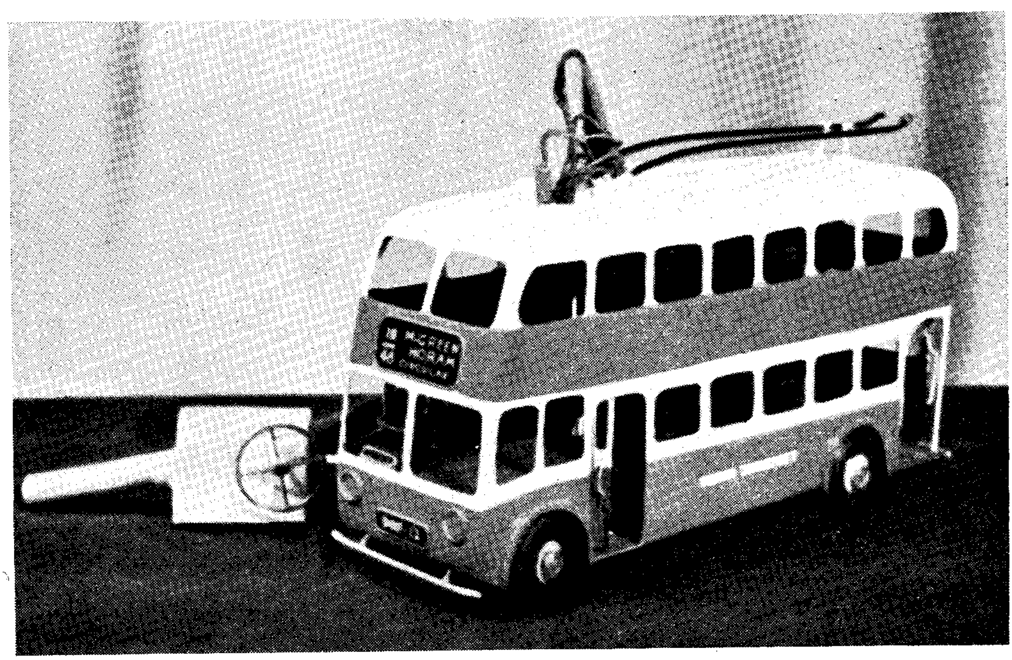
End elevation of model trolley bus



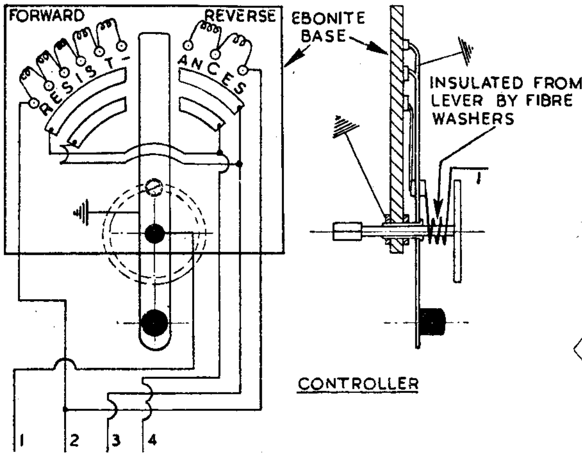
Diagram, showing the general wiring of the model

of these can be used for the inside of these arches. The size of the front arches can best be got by drawing out the front axle, wheel, etc., and then drawing them again on full lock, taking the stub axle pin as centre pivot. I made this floor in two pieces because of tin shortage; this is easier than making it in one piece and allows for any inaccuracy. Overlap them about ½ in. near the middle.

The top floor cannot be complete owing to the battery being in the middle, but is made just long enough each end to allow the battery to be put in or removed. The vertical partitions are then needed. I found the easiest way was to make templates out of thin cardboard first, cutting them to size, then tracing round them on the tin. Mudguards are strips of tin. To bend the edges over I used an old ball-race about the size of the wheel arches, wrapped the tin round it tightly, then gripped both in the vice

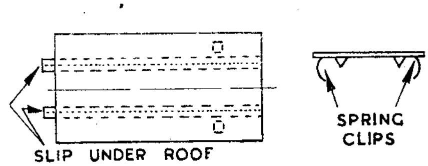


The completed model with controller



Diagram, showing wiring of controller

axle were turned to $\frac{3}{16}$ in. to take the wheels (these are turned in oak and bushed with copper tubing $\frac{3}{16}$ in. inside diameter). Sketch shows how the fixed wheel is fitted, enabling the model to be pushed along if desired. One wheel is left free, this being the reason why the front axle is free to swivel so that the driving wheel is always in contact with the ground.



Two views of the "lid" on roof, enabling battery to be removed

and beat over the edges. These are then soldered on to body.

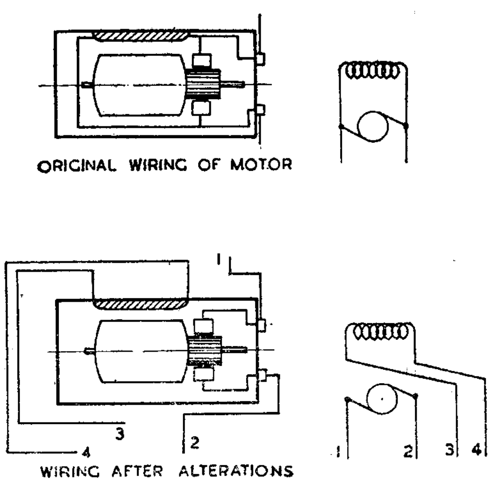
The roof itself is soldered on, consisting of two pieces of tin fixed at each end and a "lid." This lid just springs off and on. The imitation pick-up arms are $\frac{3}{16}$-in. rod ground off to a taper and blobs of solder on the ends. These just swivel up when the lid is removed. Now for the mechanical side of the model.

The front axle is as shown in the sketch. The power unit is a Lucas S.W.4 wiper motor, 6 V. This is an ideal motor for the job, being very powerful, slow revving, and easily adaptable. The housing is cut and just the worm and first motion gear used. The "motor" is fixed to the "gearbox" housing by two screws. A plate was made to sandwich between these parts and this was drilled and bolted to the floor. The gear wheel is pressed on to the shaft, which is removed and another longer one pressed through forming the axle. The ends of the

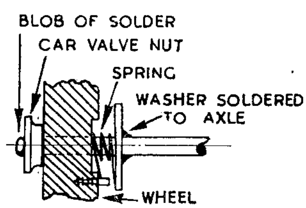
Hub caps are car valve nuts, polished and plug terminals soldered in the centre. The electrical connections were next worked out as follows.

The motor is not a permanent magnet type, otherwise the wiring would have been very simple. I have drawn a sketch to show how the motor was altered to enable it to be reversed. The wires go up the window pillars out of sight and fit to sockets in the roof, with push-in plugs, so that the controller can be detached in a few seconds by unscrewing the speedo cable end and pulling out the connection plugs. I needed five distinct connections between bus and controller. I used the material to hand: some old wireless-plugs, two lengths of twin car-lighting wire, the speedo cable being employed as earth for one connection.

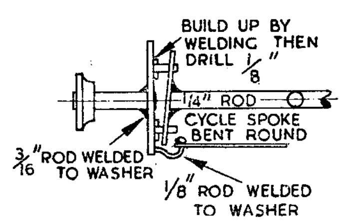
The controller I made up also from wireless scrap, to date it functions perfectly. The base is a piece of ebonite, the swivel for arm being hollow to allow the steering shaft to go through.



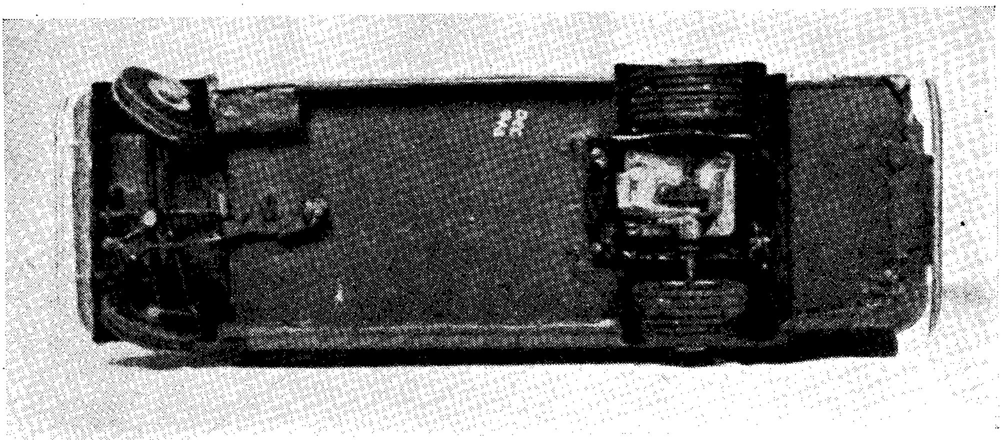
Wiring of wiper motor



How driving wheel is locked to axle



Showing construction of stub axle



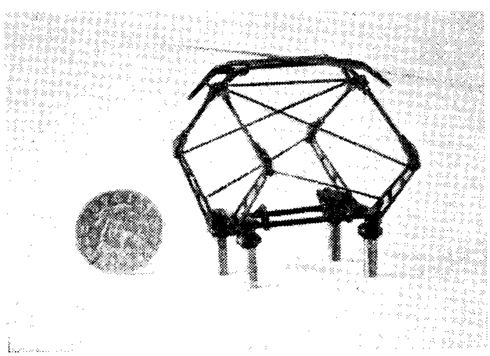
Underneath view of the model trolley bus

There are five forward "speeds" and two reverse. The resistance wire is from a rheostat which at one time did service in a wireless set, looped in at each contact. The steering wheel in the cab is fitted up to turn so that the model can be pushed around; also, I have made another one to screw on to the roof where the speedo cable fits. The edges of destination boards and number plates are pieces of $\frac{1}{16}$ in. brass wire soldered to the body, lamps are made from plug washers, and the model is painted and finished in red and cream.

The trolley bus is now complete, at least as far as I am concerned. Many extras and refinements could be added, but as my time is limited and the model was really a Christmas present for a boy aged 6 years, there would have been no point in fitting anything else. It runs a very long time on the battery, and when flat out does about 2 m.p.h., which is quite fast enough for indoors. I have not found anything to halt its progress other than wheelspin!

A Model Pantagraph

LOOKING over some back numbers of THE MODEL ENGINEER and re-examining Mr. V. B. Harrison's electric locomotive pantagraphs (page 381, March 27th, 1947), it occurred to me that readers may be interested in my efforts in this direction.



Although not a model of any particular prototype, this pantagraph follows general practice, except that the spring raises instead of lowers the pan. It is built to 7 mm. to 1 ft. scale. As can be seen from the photograph, the unit is made to plug into the top of the locomotive, insulated sockets being provided for this purpose. This enables it to be replaced if it becomes damaged in collision with any projection. In practice, although it has suffered many severe buffetings, it seldom becomes hurt in the process. Two pans, or actual current collectors, are provided, sufficiently far apart to bridge section insulators in the overhead wire, and to prevent the pan carrier tilting and collecting on the edge of one pan. This also obviates the necessity for what can only be out-of-scale springs at the top of the model. The actual current collectors are of flattened copper wire, which clip into position so that they can be changed when worn.

The four diagonal braces extend into the fork joints to form the pivots. This not only simplifies construction, but reduces the resistance of these joints very considerably. The spring is adjusted to maintain a tension of 30 ± 2 grammes over ± 5 mm. variation in the height of the overhead wire. The overhead wire is not cleaned, but the flattened copper current collectors are sandpapered after the first few runs if the line has not been used for a few weeks.

No arrangement is made to lower the pantagraph when not in use.

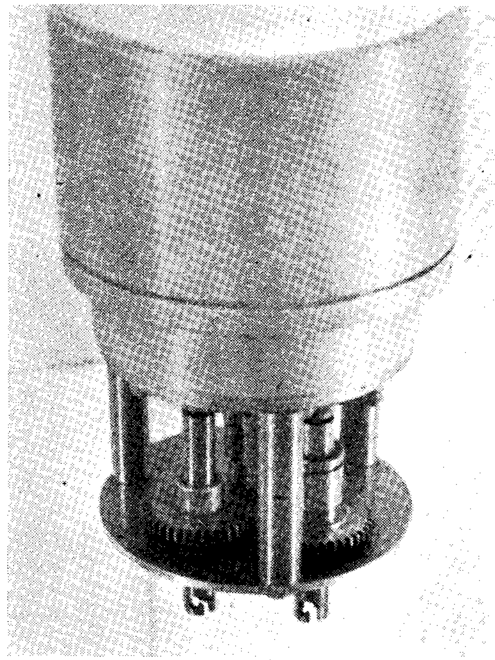
The first one, made over 10 years ago, is still in use, and appears to be as good as new.—F. J. ROWBOTHAM.

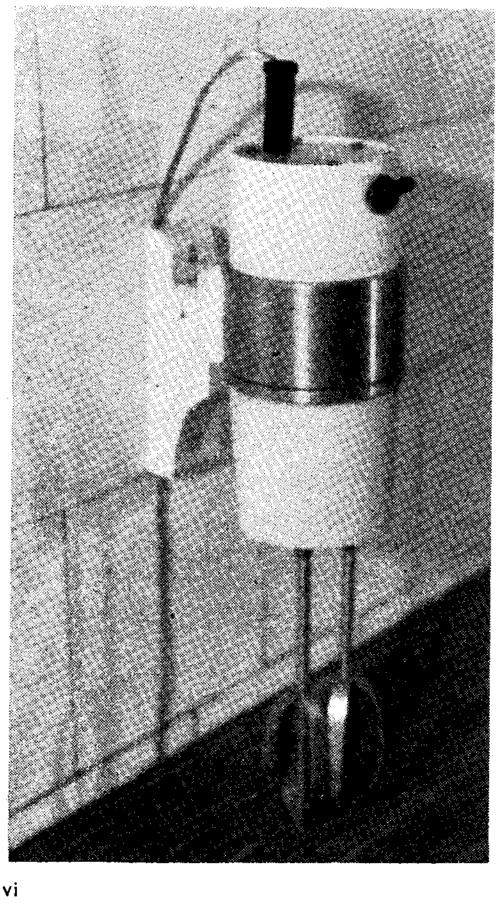
A Contribution to the Kitchen Front

by J. A. Pilkington

I LIKED "Workshop Widow's" article in the March 9th issue about making something for the home as a peace offering to one's wife! and it crystallised something which had been in my mind for some time. My wife had been wanting a kitchen mixer but the cheapest is not much less than £15 and so it looked as if she had "had it" unless I could make one.

I got a very neat little ex-service motor from a "M.E." advertiser for 15s. 6d.—220 volt, 50 c.p.s., $\frac{1}{16}$ h.p. The motor runs at 2,800 r.p.m. and this had to be geared down about 4 : 1 to give the correct speed for the mixing blades. The gear wheels I got from a bombsight computor which I bought from another "M.E." advertiser for 25s. (incidentally, this computor is an absolute





mine of spare bits and pieces—it has already supplied, amongst other things, a set of driving gears and a steering worm and gear for a $\frac{3}{4}$-in. scale traction engine I am making).

The drawing and photographs are self-explanatory. I have not given dimensions on the drawing, as this is one of those jobs which you make up as you go along, depending upon the materials available in the "spare bits" box.

The white plastic covers to enclose the wiring and switch at the top and the gears at the bottom are cups from Woolworth's with the handles cut off and trimmed down in depth as required. Do not forget to pack the gears with grease before covering them up.

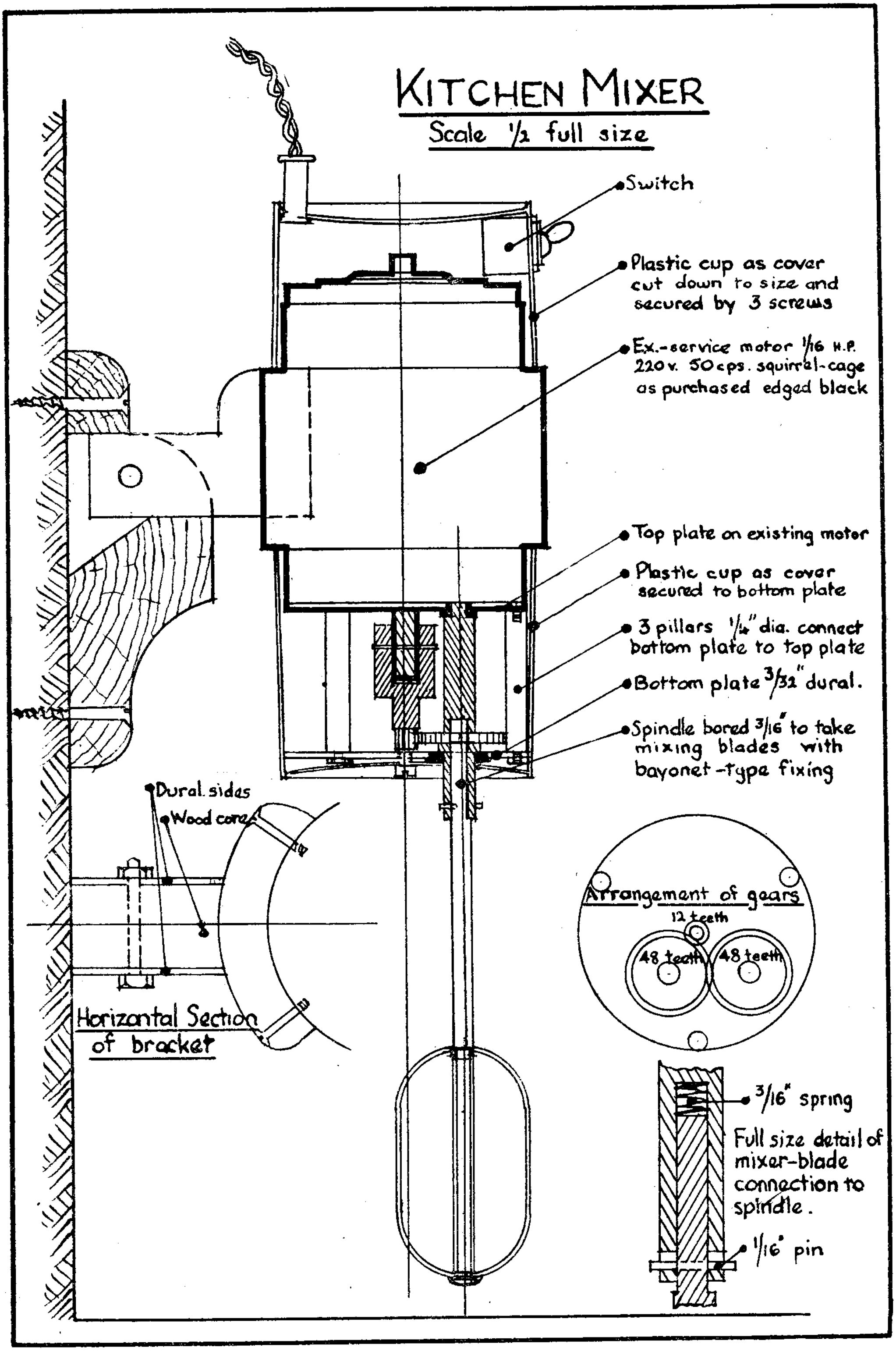
The mixing spindles and blades are duralumin (or, better still, stainless-steel) and must be about 5 in. to 6 in. long from the underside of the casing. (For details see wife's egg-whisk.)

In my case the whole thing is fastened to the wall with a bracket as shown, but if there is no wall available a baseplate and pillar would be equally suitable.

The motor, as purchased, is not self-starting but can be made so by introducing a condenser into the circuit in accordance with the instructions supplied with the motor. I did not find this necessary, as only a slight push is needed to set it going. It will be seen that when in use the mixer tilts back to get the basin under.

Tell your wife that as well as whipping eggs, cream, etc., the gadget will mix the average cake and sponge mixtures, beating masses of air into the mixture, which, I am reliably informed, is the secret of light cakes.

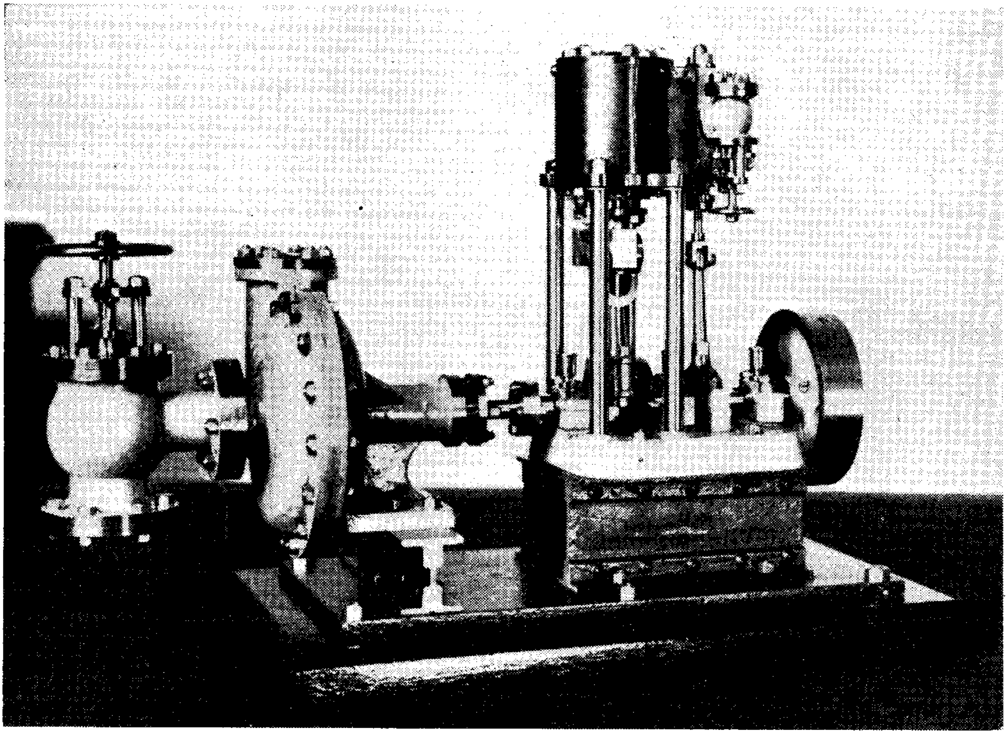
I reckon this job is worth about six months' peace to enable me to get on with the serious work on my model traction engine.


KITCHEN MIXER
Scale ½ full size
Switch
Plastic cup as cover cut down to size and secured by 3 screws
Ex.-service motor 1/16 H.P. 220 v. 50 cps. squirrel-cage as purchased edged black
Top plate on existing motor
Plastic cup as cover secured to bottom plate
3 pillars ¼" dia. connect bottom plate to top plate
Bottom plate 3/32" dural.
Spindle bored 3/16" to take mixing blades with bayonet-type fixing
Dural. sides
Wood core
Horizontal Section of bracket
Arrangement of gears
12 teeth
48 teeth
48 teeth
3/16" spring
Full size detail of mixer-blade connection to spindle.
1/16" pin

A Steam-driven Pumping Set

by Geo. Perrem (Johannesburg)

DURING the course of destroying many photographic negatives, exposed and developed in the good days of long ago, at a time when it was possible to purchase a dozen half-plate negatives of any famous brand very cheaply for direct contact work, I came upon one, which, reproduced photograph. There was no lathe aboard, but a large hand drilling-machine was available in good condition, similar to those usually fitted in blacksmiths' shops. Beyond the stop-valve, which I added later when ashore, all was carried out during my watch of



after seeing the interesting picture on the cover of No. 2530, of THE MODEL ENGINEER, I thought might be of general interest.

When carrying out my duties as second engineer on one of Britain's nice little tramp steamers [?] on which I was employed, before the days of the installation of wireless, electric light and, refrigeration, I was rummaging around the engine room store, putting things straight, preparatory to meeting foul weather. On tipping over a small waste bin, to my astonishment out rolled a small bronze cylinder casting of approximately $\frac{5}{8}$ in. bore and stroke, and this led to a further search, when a bedplate and pump castings were found. By their quality I suspect they were produced by that famous firm at Henley-on-Thames.

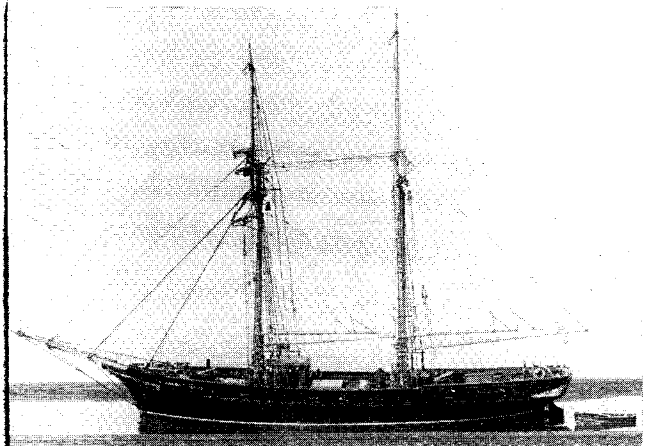
I decided to attempt to put the set together, with the few small tools that usually accompanied me when at sea ; the results are seen on the 4 to 8, most irregular ! But there, the engine-room equipment needed little attention except the usual feeling around and oiling at half-hour intervals, of one triple expansion main engine, a donkey-pump, and a couple of Scotch boilers, and no frills.

There is little to say regarding the construction; it is just simple hand exercises, which today are described by many talented writers over and over again, not forgetting " Curly." The small hexagonal nuts, which were filed up from round rod, needed all my patience, and it is only by luck I did not fit cheese-head screws, which I detest when wrongly placed.

The set was constructed as a mantelpiece ornament, but has been lent out with some reluctance, to assist at exhibitions, where it has been employed running and pumping for long periods. It is now just about worn out, but with

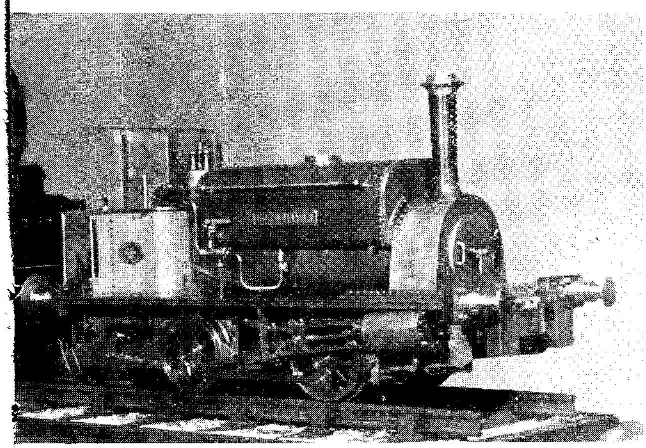
(*Continued on page* x)

"M E" Exhibition Close-up



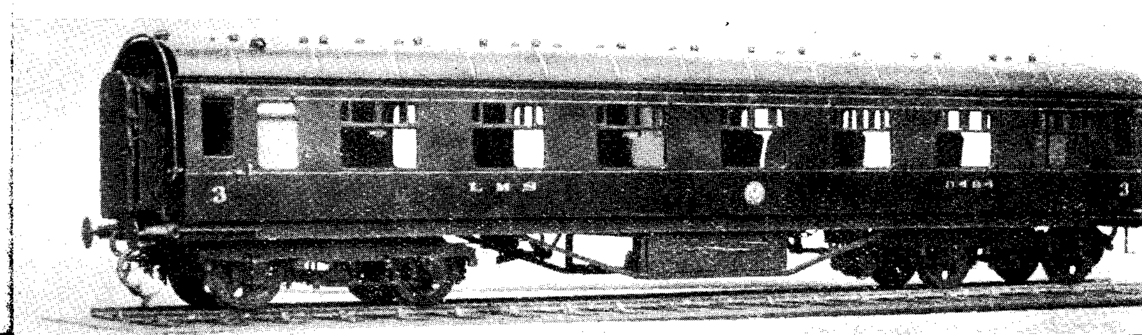
Above.—A well-proportioned topsail schooner by Mr. Alex R. Todd, of Uddingston, Lanarkshire, full of interesting detail

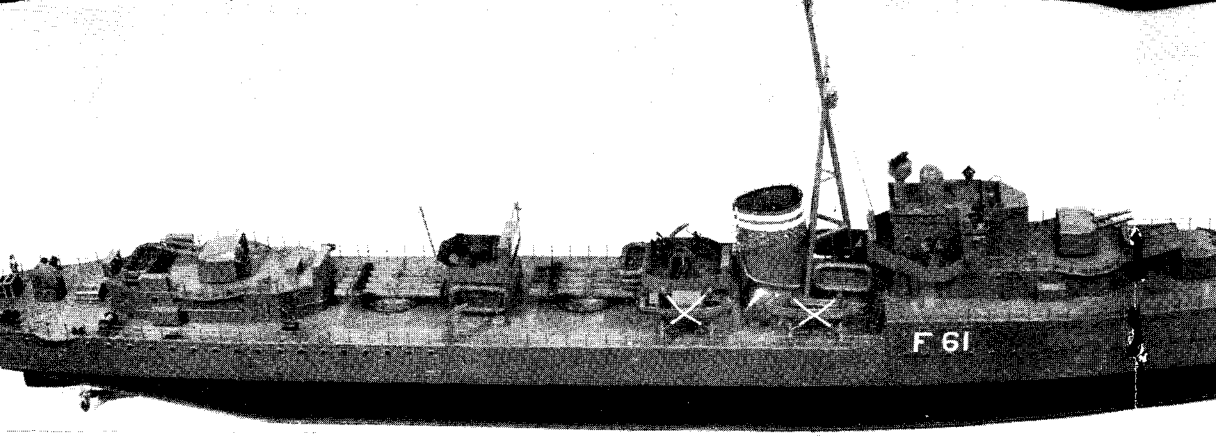
Below.—Mr. P. J. Dupen's 5-in. gauge contractors' locomotive



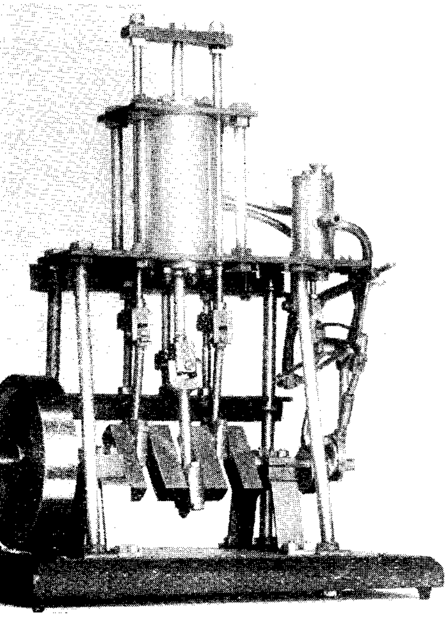
Above.—J.N.M., E.TW. and E.B. do some judging

Below.—Mr. D. M. Honeyman's $\frac{3}{8}$-in. scale L.M.S. coach

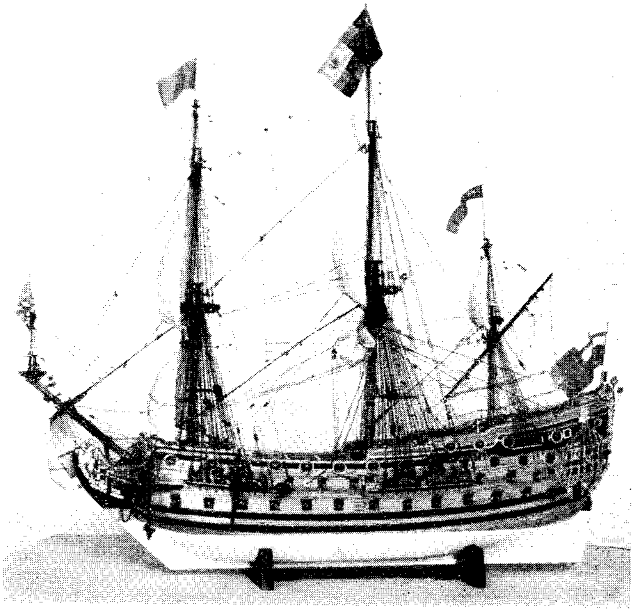




A 6-ft.
Javelin
We

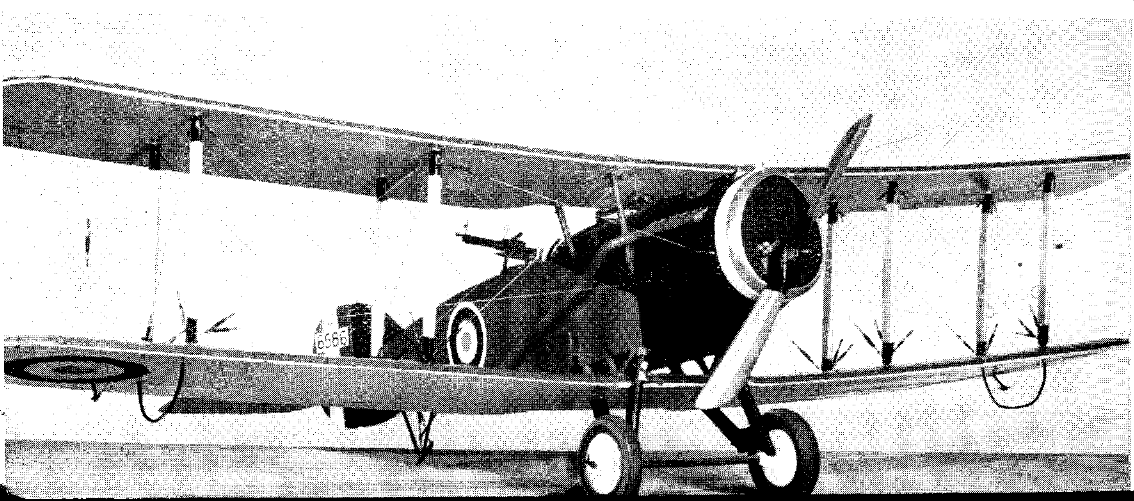


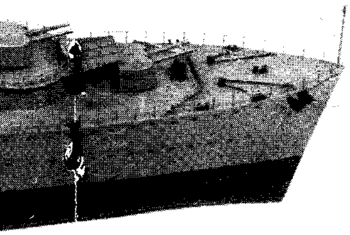
Mr. P. Minto's interesting opposed-piston marine engine



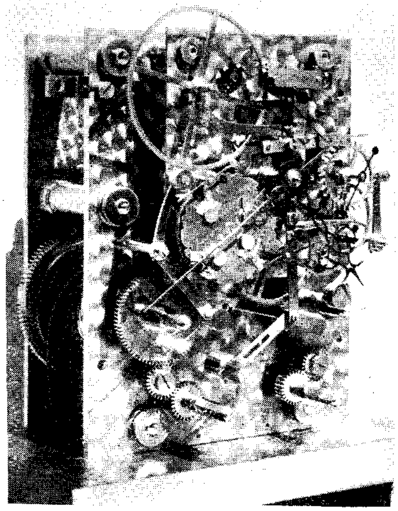
A beautiful model of H.M.S. *Prince* (1670) by Rear-Admiral C. M. Blackman, of Ashton, Hants.

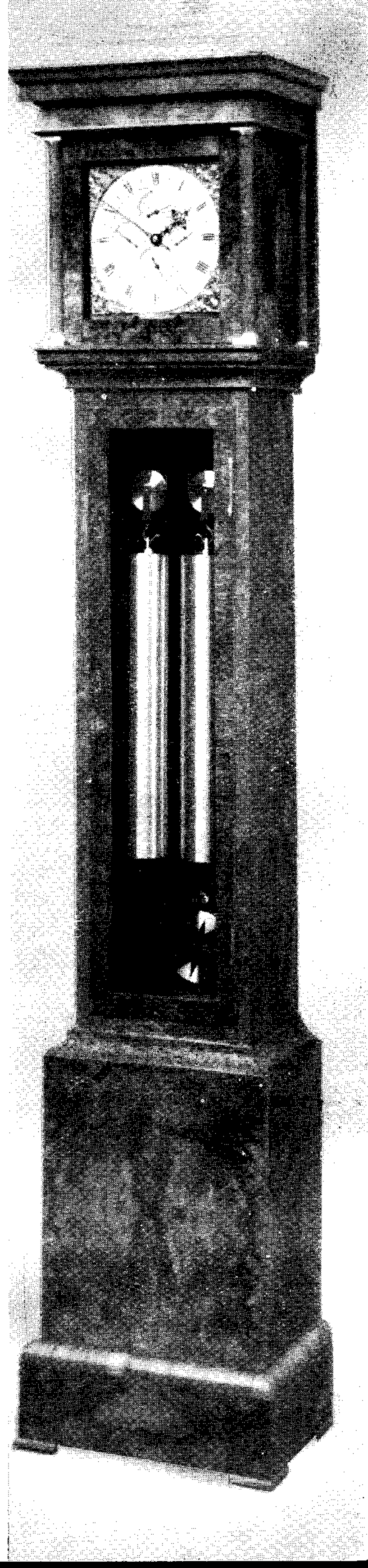
Below.—One of the two exhibits entered in the model aircraft section by E. J. Pithers, of London, W.11, this model of a Bristol fighter type F 2B is noteworthy for its fine detail



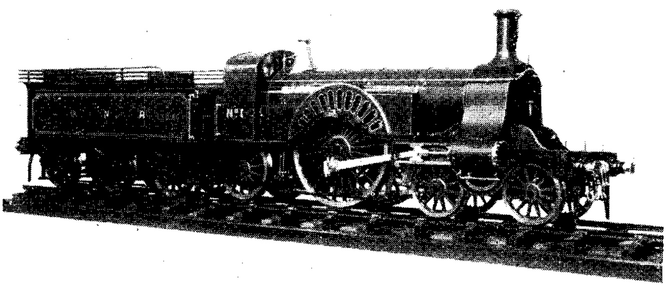


A 6-ft. model of the destroyer *Javelin* by Mr. G. W. Miller, of West Drayton, Middx.



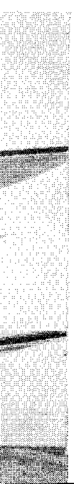


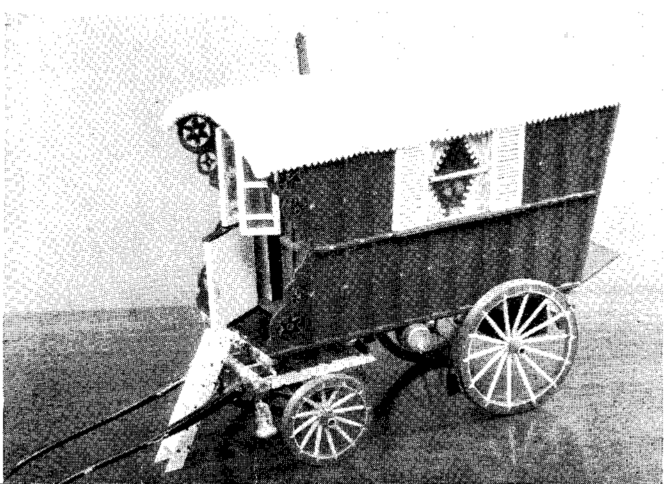
Above, the "works" and, right, the handsome exterior of Mr. C. B. Reeve's long-case clock with perpetual calendar

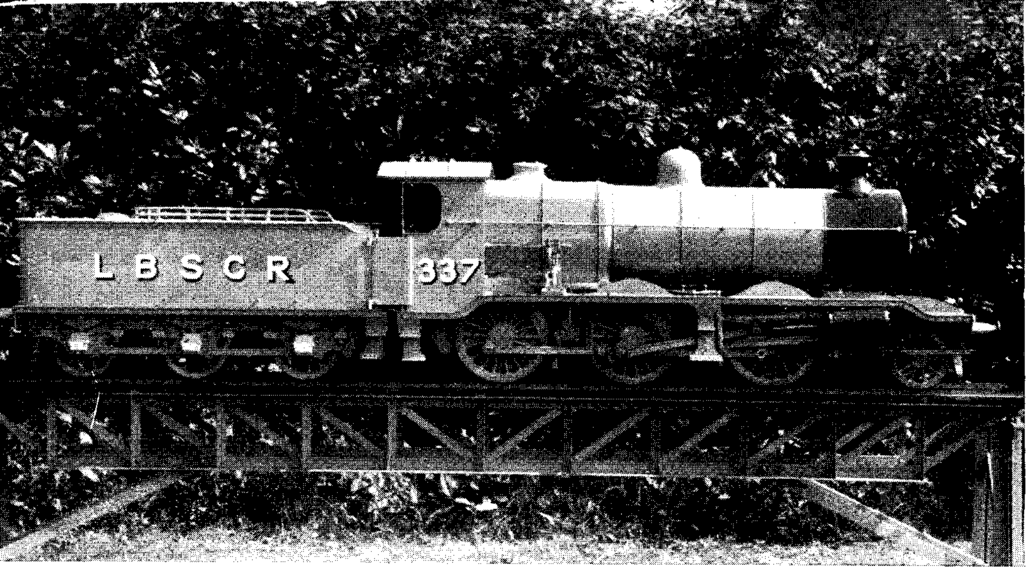


Above.—Mr. F. W. Hebblethwaite's beautiful $\frac{3}{4}$-in. scale G.N.R. Stirling single locomotive

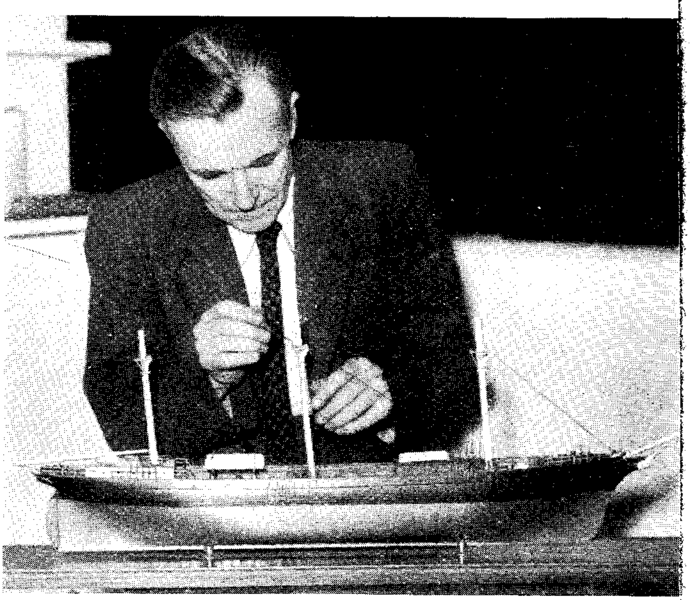
Below.—Mr. F. J. Pateman's 1-in. scale, completely fitted gipsy caravan



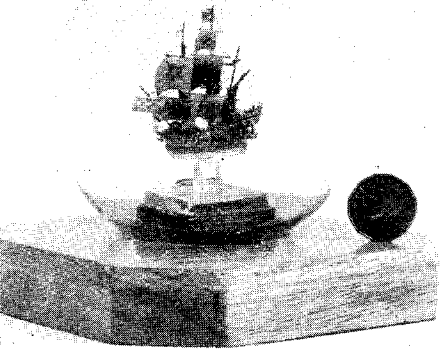




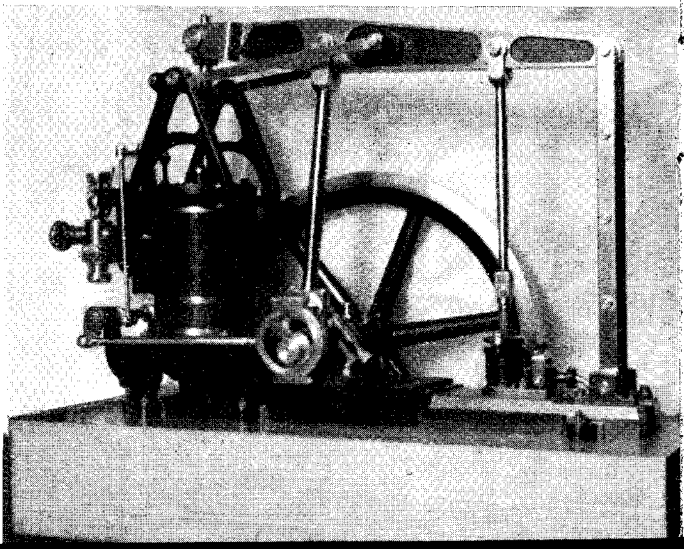
Above.—Lt.-Col. L. B. Billinton's 2-in. scale replica of his own full-size 2-6-0 express goods locomotive



Right.—Mr. I. W. Marsh, of Barry Dock, Glam, at work on his model of the clipper *Thermopylae*



Above.—A variation from the ship-in-bottle type by Mr. Peter F. Marsh, of South Ealing, W.5.



Right.—Mr. H. J. Hawker's 1-in. scale "grasshopper" engine

Thinking in Terms of Tools

by C. Baker

VISITS to other people's home workshops are always interesting and often quite revealing. Some men possess a building well equipped with commercial machines and abounding in home-produced jigs and gadgets which would do credit to a professional model maker's works, whilst others are content with a minimum of tools and are prepared to " make do " with whatever comes to hand. To them the current model is the only thing that matters and the time spent in designing and producing special tools is a sheer loss to be avoided at all costs. True, the larger and more complicated appliances can become appreciable model jobs in themselves, but their use may add just that touch to the final product which will raise it from the plane of the ordinary to that of the prize winner and get it finished before its maker's enthusiasm begins to wane.

And it is not necessarily the bigger tools which are proportionately the most useful. The everyday file, spanner or screwdriver are all possible subjects for modification or adaptation to special duties. The last two items, in fact, were well in evidence with the writer, when recently confronted with the task of fitting some dozens of 12-B.A. screws and nuts and a similar number of small woodscrews, and they will serve to illustrate the point under review.

There are, perhaps, few jobs more exasperating than, say, trying to insert the bare end of an electric flex into a hole of a small terminal in a ceiling fitting which is almost out of reach. One's arms ache, the screws fall out and disappear, the wire unravels and when it is got into position at last, the new screw becomes cross-threaded! Now, even a fraction of this irritation could not be tolerated in putting together the model—a railway coach. And so, after arranging the job in the most convenient position on the bench, a little thought was given to the screw and nut tools that were lying around. No! they were not all that was to be desired.

There are, of course, a great variety of commercial appliances : electric self-feeding screwdrivers, ratchet screwdrivers, insulated and magnetic screwdrivers as well as spanners whose patterns vary from that of the common wrench to the precision torque recording type. But which of these were excluded by reason of cost or expediency? All of them! Diminutive screws and nuts are " fiddling " to handle and can only be used quickly if they can be picked up and held with ease and a simple means of achieving this end was all that was wanted. Some improvising then followed and out of it emerged the two designs illustrated.

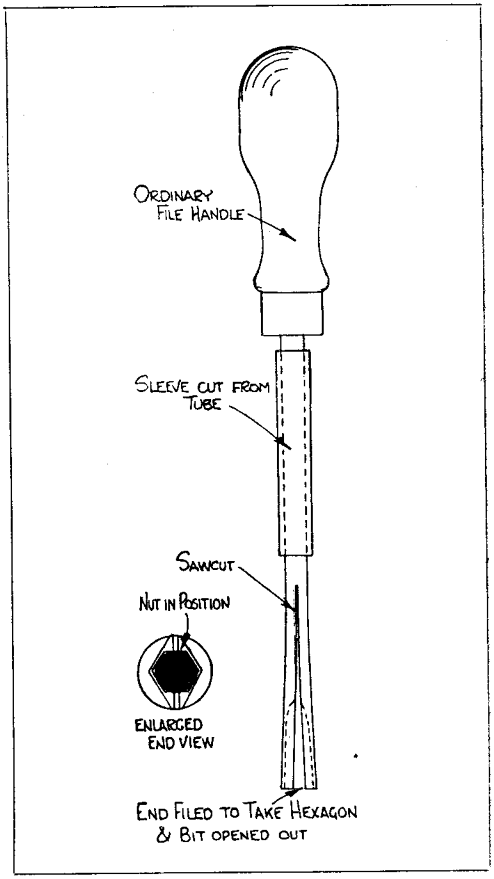


Fig. 1. *A simple box spanner*

The simpler of the two tools—the spanner, Fig. 1—can be made up by anybody in half an hour or so. It consists of a piece of mild-steel bar held in an ordinary file handle. The " business end " is split longitudinally by a thin saw cut, producing a springiness to the tip which is shaped to accommodate the opposite corners of a nut hexagon. The jaws of the tip or chuck hold the nut by means of a tubular sleeve, which telescopes over the bit and is slid down when the tool is placed over a nut lying on the bench; this closes the jaws and grips the nut which can then be screwed in position on the job Several different sizes of hexagon can be accommodated in a box spanner of this kind provided the saw cut is long enough to allow a gradual opening of the bit so that the sleeve can slide down and grip without slipping it or binding against too sharp a taper. All kinds of refinements may be added such as a thumb lever for the operation of the sleeve or even a magazine within a hollow bit from which the nuts could be dispensed one at a time, and, of course, the bit

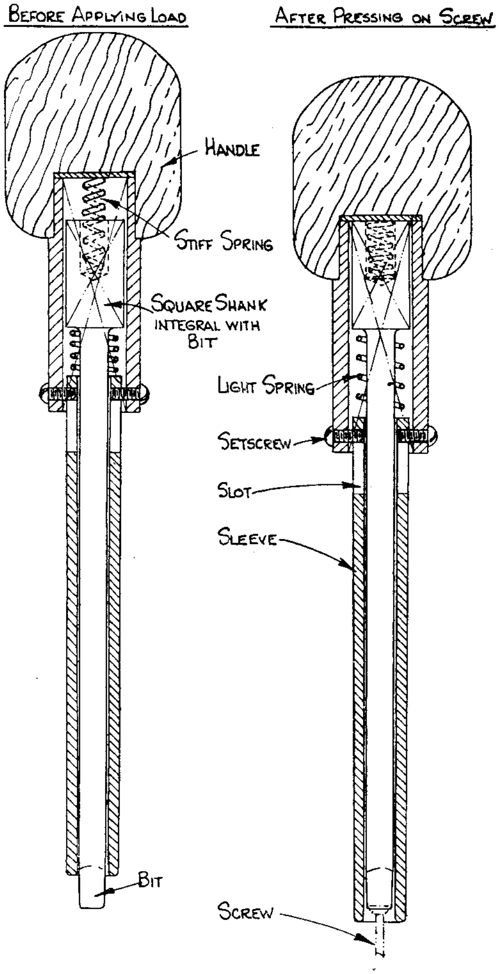


Fig. 2. *A screwdriver with locating sleeve*

should be hardened, especially for larger nuts. The extent to which one would introduce these additions would be dictated by the extent and peculiarities of the job in hand.

A more elaborate tool is represented by the screwdriver shown in Fig. 2. With rapid repetition work there is always the risk of the driver slipping out of the head and damaging the work. It is a real danger in the case of highly finished surfaces or when inserting screws into soft woods. Commercially it is overcome in many ways, frequently by the use of cruciform or square recessed heads, although the ordinary slotted head presents few difficulties if the screwdriver is held over the nut by means of a suitable sleeve. It can be quite a simple thing but it is thought that the more elaborate design shown will be more interesting to readers.

Essentially the tool consists of a bit free to slide in the handle, or rather an extension of the handle, but prevented from turning independently of it by a square shank sliding in a square recess. The bit is loaded with a relatively stiff spring and a sleeve through which it passes is lightly spring-loaded. The spring is retained to the handle by a set screw working in a slot.

When the bit is placed in the screw slot and pressure applied to drive the screw, the stiff spring is compressed and the sleeve slides down over the head and positively locates the screw; this continues until the screw is home when the sleeve touches the surface of the work and lifts against the pressure of the light spring. The latter is insufficient to cause the sleeve to scratch the finished surface, whilst if any precaution is deemed necessary a soft wood or rubber insert could be fitted to the end of the sleeve.

The design could, in fact, be varied in many ways. No special claims of any kind are made for the type illustrated, neither has the writer any financial interest in tool manufacture! The question of making up special tools by the amateur model maker has been raised because it is felt that it is a matter which has been somewhat neglected and it is hoped that readers may benefit from the viewpoint expressed.

A Steam-driven Pumping Set

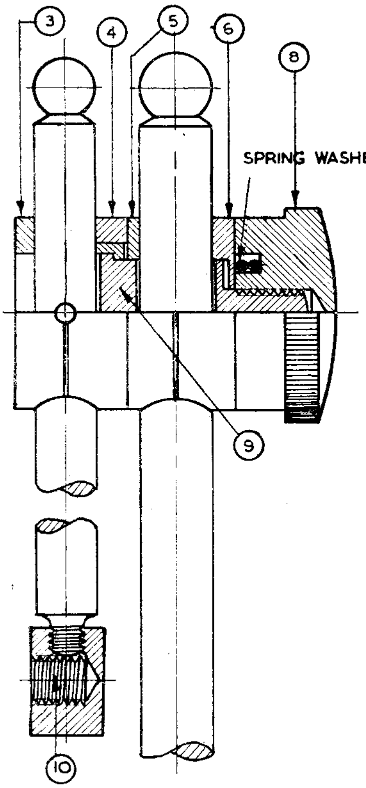
(*Continued from page* viii)

an overhaul will be quite satisfactory for the original intention—the mantelpiece. I suppose after that, someone in the near future will sling it in the garbage-can as a bit of useless junk of the past, like the negative.

I trust my description of a similar set to that built by "Crankhead," together with the writings of E. T. Westbury and others on steam matters, will lead to a revival in the interest in what is now known as "the old fashioned steam engine," both stationary and marine. Many beautiful examples are easily found as yet, and can be constructed in simple or elaborate forms depending on the requirements and skill of the builder. These engines still prove of great interest at exhibitions particularly as working models, judging by the few I have had the opportunity to attend; but in many cases, the same engines are in evidence over and over again.

I plead guilty to dropping my own efforts in favour of locomotives, but once my programme in that direction is complete I shall again turn to my first interest, marine and stationary engines. But there, the negative destroyed is over thirty-six years of age and, I have been a regular subscriber to THE MODEL ENGINEER since its inception; time marches on, and who knows?

Before concluding I should like to join in with others for a come-back of the "M.E." undertype and overtype engines described in back volumes. These would, I am sure, attract the attention of many locomotive builders, and others, as a change.



A Clamping Device for a Dial Test Indicator

by Andrew Todd

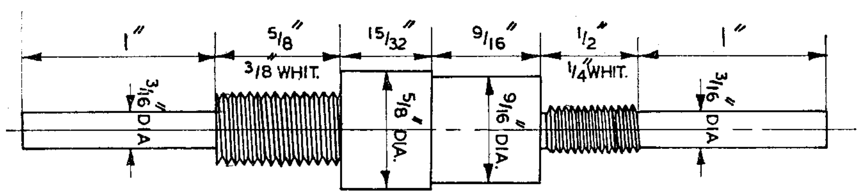
THE accompanying drawings show a clamp I have made to carry a clock gauge. It is a neat clean design, made entirely on the lathe, no hand work being done on it at all. It slides easily and clamps up firmly with an easy pressure on the locking-nut. I have not shown a base or foot for the pillar, as they can be made up in many different ways from available material. My pillar screws into the bases of which I have two, one for surface plate work and the other for the toolpost of the lathe. I also have a few short pillars which screw into the saddle and cross-slides of the lathe. The pillars I use are $\frac{3}{8}$ in. diameter silver-steel. The arm to carry the d.t.i. is $\frac{5}{16}$ in. diameter silver-steel. By removing this arm I can fit in its place a $\frac{1}{8}$ in. diameter silver-steel scriber for use as a surface gauge for marking-out purposes.

I also use the clamp a lot in my work. I have two lengths of silver-steel rod with bent and pointed ends. With these in position in the clamp I have an excellent pair of really stiff dividers, which I use for a lot of bigger jobs than one finds in model making. I also have a pair of inside and outside caliper legs to fit the clamp. I get a lot of awkward jobs to measure up, and it is handy to be able to pick up a piece of rod and bend it to fit round corners when measuring the diameter of pipes etc. Ordinary calipers take too long to make to mutilate in this manner.

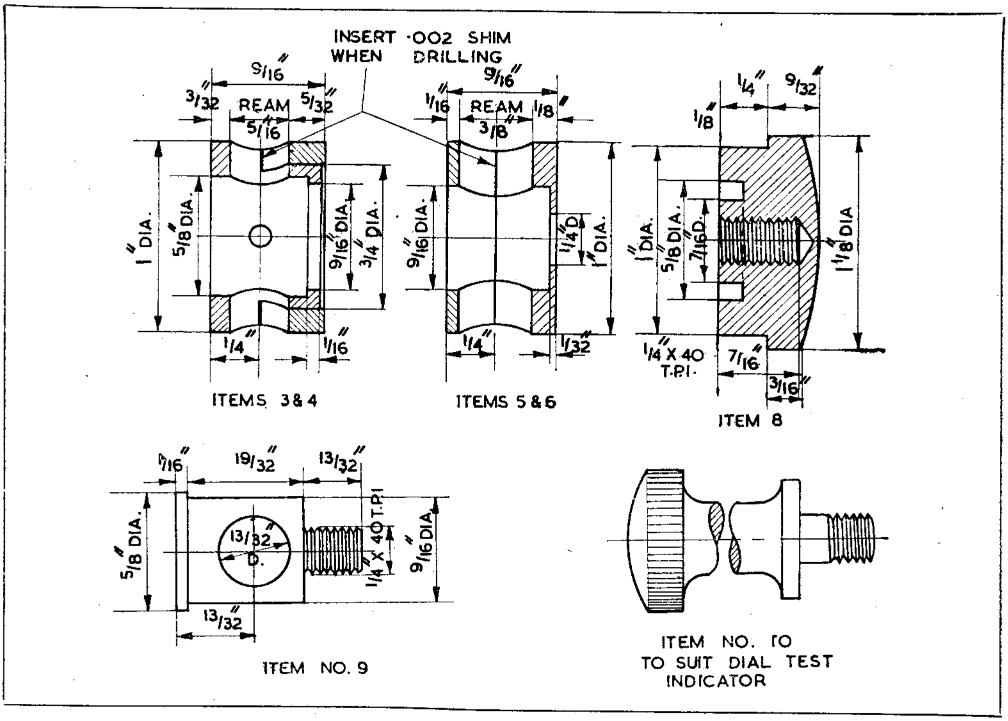
Two of the clamps mounted on a length of straight bar with short pointers fitted in them make a good pair of trammels, or they can be used again as calipers with the legs in position. The clamp was not intended to be used for these purposes originally, but has been used for them much more than for the job they were designed to do. In making mine, I did not go to the trouble to make such an accurate job as I am going to describe.

A young friend has started to serve an apprenticeship as a fitter and turner. He has a small 3-in. centre lathe of his own. He was using my clamp one evening and remarked how handy it was, and wanted to copy it. The holes in mine were not drilled accurately through the centre of the clamping washers, with the result that when one of the clamping washers is turned through 180 deg. the pillar or arm will not enter the hole. I suggested that he drilled them accurately so that they would fit in any position. This he did, and he made an excellent pair, and also a smaller pair to fit a small surface gauge. Except for the drilling of the holes, all the parts can be made by simple turning. Drilling the holes through the washers was a problem and the following method was adopted.

Mandrel used for drilling clamping washers



A morse taper-plug was made to fit the mandrel of the lathe, and $\frac{1}{2}$ in. was left projecting from the nose. This was turned down to $\frac{1}{2}$ in. diameter. A washer was made a good fit on this end of the plug, $1\frac{11}{16}$ in. diameter and about $\frac{1}{2}$ in. thick. A mandrel was also made to sizes shown on the drawing, care being taken to get the ends the same diameter and true with each other. Two 0.002 in. thick brass shim washers were made to fit between the clamping washers. The drawings show the set-up adopted. The taper-plug



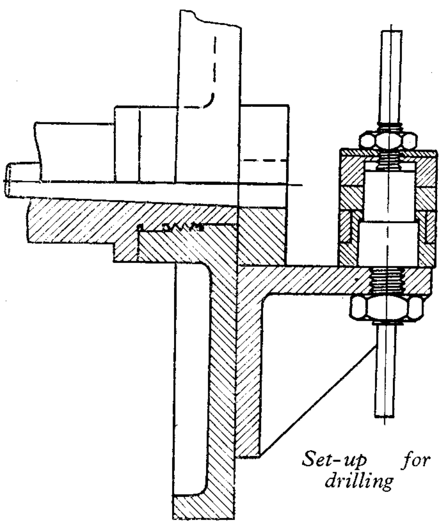
was put in the lathe mandrel, and an angle-plate was mounted on the faceplate. A hole was drilled in the angle-plate to receive the mandrel, on which the clamping washers were to be mounted.

With this mandrel horizontal across the lathe axis and the angle-plate pressed tightly against the plug in the nose, the height of the ends from the lathe bed was carefully measured with a surface gauge, on turning the lathe spindle through 180 deg. the height of the ends being again checked. They should be the same in both positions, and the angle-plate should be moved one way or the other across the faceplate until the readings are the same, taking care that the angle-plate is kept tightly pressed up to the plug. The hole should be drilled and tooled out, and finally reamed to size. To drill the $\frac{1}{8}$ in. diameter hole, the same procedure is gone through again, a short piece of $\frac{5}{16}$-in. rod being inserted in the hole already drilled. This rod is set parallel to the face-plate and ensures that the holes are at right-angles to each other.

The same procedure was adopted to drill the $\frac{3}{8}$-in. hole for the pillar. In this case, the angle-plate was pressed tightly against the washer which was made to fit the taper plug. After the holes were drilled the brass shims were removed, their purpose being to give a slight clearance between the clamping washers so that when they are tightened up the washers would tighten on the pillar or arm before the faces of the washers met.

The spring inserted in the locking-nut was made from a small key ring opened out a little. It works very well.

The central clamping-bolt was drilled in the four-jaw chuck, as the hole is a clearing one only. The boy did not find the job at all difficult, that is, with the exception of the nut. He had a lot of trouble turning the groove in its face to receive



Set-up for drilling

the spring, and to make a nice job of the milling on the edge. He was a proud lad when he brought a pair of well finished clamps for my inspection, and demonstrated that all the washers were interchangeable with each other.

Turning a Six-throw Crankshaft

by E. G. Rix

THE original crankshaft from which the model was copied, was one of a batch of assorted crankshafts I saw in an engineering works awaiting a regrind.

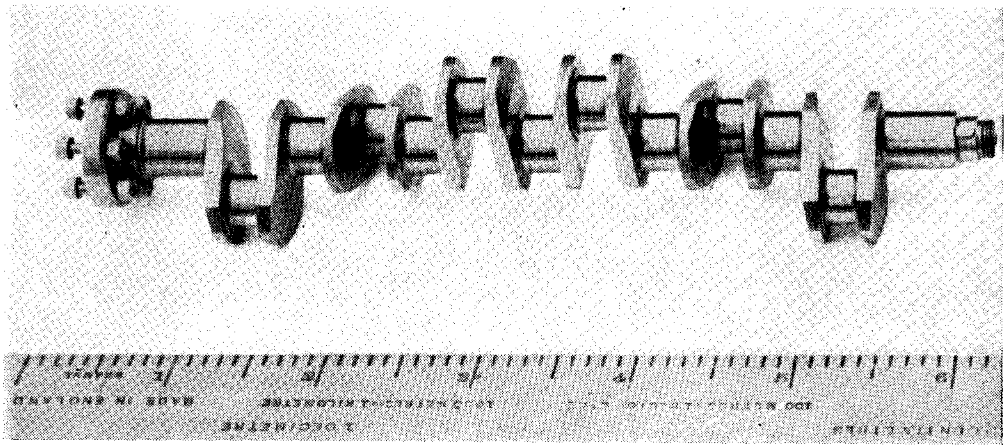
The notion to make a model of this description had never entered my head, until looking at the collection of shafts I began to think of my lathe at home and wondered if I could produce a small replica to any degree of accuracy. In the few minutes of pondering over the matter, I was so intrigued with the difficulties that I knew lay ahead, that I decided to make the attempt.

I only had time to make a rough sketch and take the main dimensions with a pocket steel tape-measure before I caught my train home ; I don't even know what make of engine the original belonged to, except that I think it is a beautiful example of engineering design, and by its proportions, I judge it to belong to the diesel class.

My first job, after reducing my rough sketches to something like a working drawing, was to set about the ways and means of roughing out the solid piece of $1\frac{1}{2}$ in. diameter $\times$ $6\frac{3}{4}$ in. long 3 per cent. nickel steel to within finishing limits.

The two ends of the blank were first faced off and centred in the lathe, holding it by the chuck with the free end in steady. Next, the job was held in between centres, and turned to make it perfectly concentric. Then by using a change-wheel for dividing, 120 deg. radial lines were scribed off at both ends. This ensured not only equal throw angles for the cranks, but at the same time maintained absolute alignment of corresponding journals.

A sharp vee-tool was next set up in the toolpost, at the required distance away from lathe centres to mark a circle at each end of the blank corresponding to the throw diameter. The intersections of the lines were afterwards carefully lightly centre-punched, and drilled for about $\frac{1}{16}$ in. deep with a 1/32 in. drill as a guide for a centring drill.



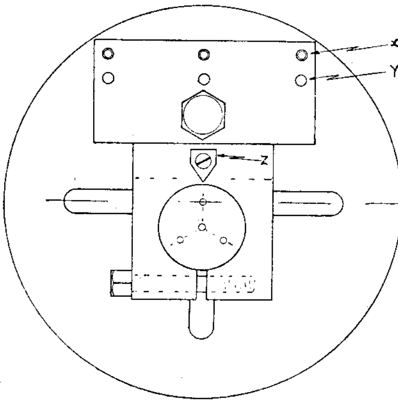
The finished six-throw crankshaft compared with an inch rule

The blank was again set up between centres, using the true centre of the stock as pivot, and the crank centres as indexing holes, whilst a pointed tool was traversed with the carriage along the periphery of the stock in its three positions. These three lines were to be used afterwards as indexing lines in the turning fixture, which was the next job to make.

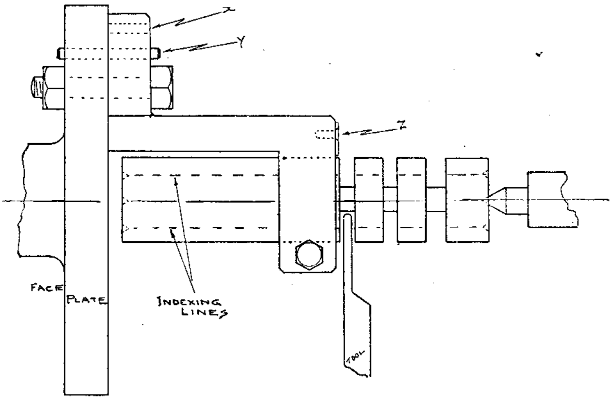
The turning fixture was a simple cast-iron one, cast at a local foundry from a hastily made pattern, and was designed to bolt on to my faceplate in two locations, one setting for turning the main journals, and the other setting for crank journals.

Referring to the sketch, dowel holes "Y" were first drilled through the casting and faceplate and dowels fitted. The casting was then bored out to fit the crankshaft blank. This is the position for turning the main journals.

With the blank inserted and bolts slackened, the dowels were withdrawn to enable the fixture to be moved, so that one of the crank centres now became a true turning centre. The tailstock brought up to the job gave an approximate position, but to obtain dead true running, a short piece of rod was fitted into the centre holes, and the whole job checked against a dial indicator, finally making sure that both the faceplate bolt and the clamp-bolt were properly tightened.



End view, showing fixture moved to "X" position for turning crank journals



Crank-turning fixture in "Y" position for turning main journals

With this set up, the remaining three dowel holes were drilled and dowels fitted. The indexing pointer "Z" was now secured to the fixture so that it coincided exactly with one of the index lines already scribed along the blank.

The fixture in this position allows for turning the crank journals, it being only necessary to rotate the blank to any one of the scribed lines to coincide with the pointer.

Although I think it makes little difference whether one chooses to turn the cranks first or last, I chose to rough out the main journals first and then to rough out the crank journals. I must make it clearly understood that the fixture can only be used whilst the crank webs are left in a disc form ; the finishing cuts are taken with the shaft in between lathe centres.

The Operations Were as Follow :

1. Rough turn to within $\frac{1}{16}$ in. of size of the main journals, allowing 0.005 in. up on each web side. Leave a disc at each end containing the crank centres for the final turning operation.

2. Anneal and straighten.

3. Rough turn the crank journals and webs as for main journals.

4. Anneal and straighten.

5. Repeat turning operations to within 0.010 in. of size on all journals.

6. Anneal and straighten.

7. Repeat turning operation to within 0.004 in. of size. Finish turn webs down to radius shoulders. Finish turn radii to within 0.004 in.

8. Check for any distortion, and correct by straightening if necessary.

9. Cut and file the round web discs to required shape and test for distortion.

10. Make and fit six small clamps to bolt on to the webs to promote stiffness whilst shaft is between centres ; also, make up small stationary steady for supporting centre journals whilst turning.

11. Main journals : Set shaft between centres, rotate shaft with fingers, taking the lightest of cuts with an extremely sharp tool on the centre journal. When this has been turned to run dead true (still oversize) the steady is positioned and adjusted to support this journal. The remaining main journals are now turned and radii finished to size by normal means. Finally, the steady is moved to one of the finished journals and the centre journal finished.

Crank journals : The same procedure as for main journals except that the greater care was necessary in turning the radii.

12. Turn down centring disc on flywheel end to form the bolt flange, also turn off disc at other end, screwcut and end-mill keyway. Polishing the edges of the crank webs completed the job.

I would emphasise that the journals were turned finished and that no polishing nor abrasive methods were used except on the flats of the crank webs.

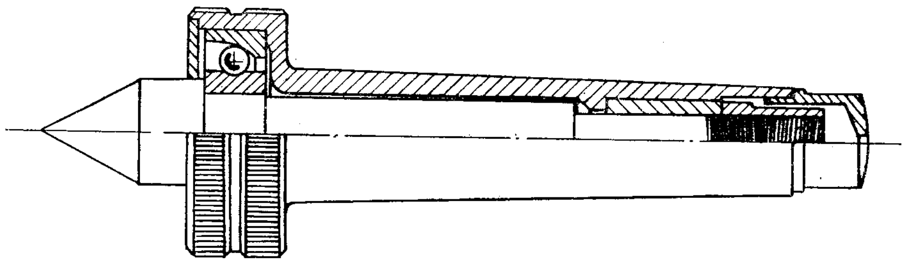
I had the shaft tested by optical projection methods which showed a distortion error over the whole length of shaft of 0.00025 in. at a room temperature of 54 deg. fahrenheit. The journals were held within limits of plus 0.0006 in. and minus 0.0005 in. in diameter.

The whole of the work was carried out on an old round belt-driven, $3\frac{1}{2}$ in. Drummond lathe, and I think I can truthfully say that this job proved to be one of the trickiest and certainly the most interesting jobs I have undertaken. Was it all as plain sailing as it sounds ? No ! I must admit I scrapped one shaft half way through. Unlucky ? No ! Just carelessness.

A No. 2 Morse-taper Revolving Centre

by S. W. Blackley

WHEN starting to construct the "1831" locomotive model I found I had quite a number of shafts, axles, etc., to make, and this meant quite a considerable amount of turning with the support of the tailstock centre. As some of the shafts were quite small in diameter, it was clear that reasonably high speeds would have to be used, so to avoid trouble with centres I decided to make a revolving centre. This I constructed as follows, and found that it was really very efficient. I also found that it was quite unnecessary to hammer the centre in or out of the tailstock socket as it could quite easily be removed by wringing it out with the hand. Taking it out in this way, of course, avoids bashing any part of it.



Half sectional elevation at the revolving centre

Bush

Make this item first. Bronze or gunmetal, ½ diameter. Grip bar in chuck, face, turn o.d. to 0.4375 in. diameter, drill, bore and ream 0.2500 in. hole. Put slight radius on corners and part off 9/16 in. long.

Body

Mild steel, 1 5/16 in. diameter × 3½ in. long. Grip in chuck by about ¼ in. and true up centre end with centring drill and then support with centre. Face, rough turn to 23/32 in. diameter × 2⅝ in. along. Skim up 1 5/16 in. diameter and knurl for ½ in. along. Set over cross-slide to an angle of approximately 1½ deg. (3 deg. included) and turn No. 2 Morse taper. Use the tailstock barrel or a sleeve to check this taper.

It is important that the taper should bear along the length. Firstly turn the taper leaving it slightly large, apply some marking compound and then check with barrel, noting where the error lies; touch over the slide accordingly and take a light cut then check again and so repeat until the Morse taper is correct and to size. Drill 9/32 in. diameter hole down for approximately 1¼ in. deep, open out to 0.490 in. diameter for a depth of ⅜ in. by drilling and boring then by the same process open out 0.437 in. diameter hole for 9/16 in. deep a press fit for bush. By using tailstock, press home bush.

Do not make the mistake of trying to fit the bush too tight, as you will only succeed in pushing the body back in the chuck and so put it out of true. With the boring tool touch up the face of the bush, also check bore by putting through the reamer. Remove from chuck.

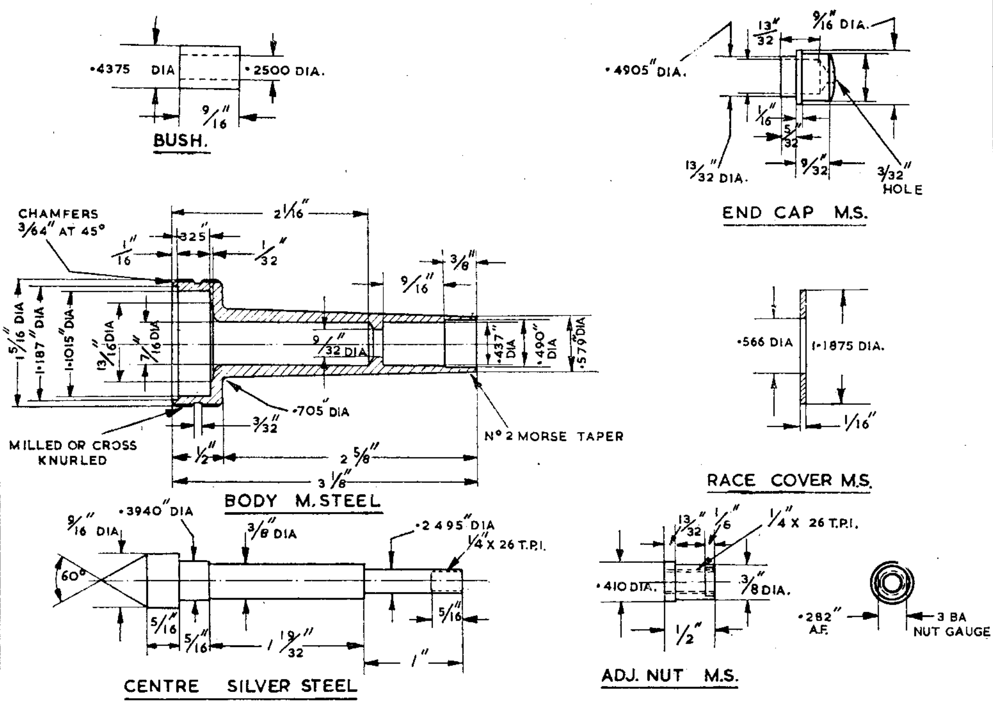
Clean tapers to ensure job will run true. Put it into headstock by inserting the Morse taper shank into the taper in the spindle. Face off material until head is ½ in. wide, put chamfers 3/64 in. at 45 deg. on both front and back corners, also turn down to depth of knurl the 3/32 in. wide band in centre of head. Drill 7/16 in. diameter hole for 2 1/16 in. deep, bore 1.187 in. diameter for 1/16 in. deep and then 1.1015 in. diameter a press fit for race for 0.325 in. deep. Next open out 13/16 in. diameter × 1/32 in. deep and put on clearance radius on corner (approximately 3/32 in. radius). By using tailstock, press outer race into position.

Adjusting Nut

Mild-steel, 7/16 in. diameter. Grip bar in chuck. Face, turn ⅜ in. diameter for 13/32 in. along and then 0.410 in. diameter for 3/32 in. along. Drill hole with 13/64 in. or No. 7 drill and tap ¼ in. × 26 t.p.i., which is, of course, ¼ in. B.S.F. Slightly chamfer corner and part off ½ in. long plus, as the bearing face must be smooth. Screw nut on dead true mandrel and face to ½ in. long over all. Cut. 0.282 in. flats × ⅛ in. long by filing or milling.

Centre

Silver-steel, 9/16 in. diameter. Grip true in chuck with approximately 4 in. protruding out from jaws and centre end. Support with tailstock centre. Face, finish turn 0.2495 in. diameter for 1 in. along and ⅜ in. diameter for 1 19/32 in. long. Next turn 0.3940 in. diameter press



Dimensioned details of the No. 2 Morse-taper revolving centre

fit for race for $\frac{5}{16}$ in. along and screwcut $\frac{1}{4}$ in. $\times$ 26 t.p.i. thread for $\frac{5}{16}$ in. along using adjusting nut as gauge. Rough turn down 60 deg. Centre taper as far as possible and cut off. Press on inner race. Leave the centre soft. *Do not harden.*

Race Cover

Mild-steel, $1\frac{1}{4}$ in. diameter. Grip in chuck. Face, finish turn o.d. to 1.1875 in. diameter, press fit in body and bore 0.566 in. diameter hole (this allows a slight running clearance for centre). Part off $\frac{1}{16}$ in. thick plus.

End Cap

Mild-steel, $\frac{9}{16}$ in. diameter. Grip in chuck, face turn 0.4905 in. diameter, a light press fit in body, for 5/32 in. along. Skim up $\frac{9}{16}$ in. diameter and drill 13/32 in. diameter hole for 13/32 in. deep, also drill 3/32 in. diameter oil hole for approximately $\frac{1}{4}$ in. deep. Part off. Gripping lightly in chuck by 0.4905 in. diameter, turn $\frac{1}{2}$ in. diameter along to leave $\frac{9}{16}$ in. diameter collar $\frac{1}{16}$ in. wide and then radius end to length.

Adjusting Screw

This is an Allen grub screw, $\frac{1}{4}$ in. B.S.F. $\times$ $\frac{5}{16}$ in. long.

Ball-race

Hoffmann A10 magneto type, or equivalent in other makes. Dimensions of this race are 28 mm. o.d. $\times$ 10 mm. i.d. $\times$ 8 mm. thick.

Revolving Centre Assembly

Clean components and assemble. Put centre into body, screw on adjusting nut so as to lightly lock centre. Screw in Allen screw to lock nut. Tap in race cover, the rough parted-off side outermost. Now place revolving centre into taper in headstock and so finish turn actual 60 deg. centre and also face up to flush the race cover with body.

Remove from machine, dismantle and clean.

Pack race with medium grade grease and oil end bush. Place into position the centre, put on adjusting nut and screw and adjust until centre is quite free to revolve but has no end play. Lock with screw, press on race cover and end cap.

Occasionally, before using centre, oil end bush through oil hole in end cap. As the actual centre is not hardened it is a simple matter at any time to touch it up by locking it with the adjusting nut, putting the whole thing into the headstock and skimming it up.

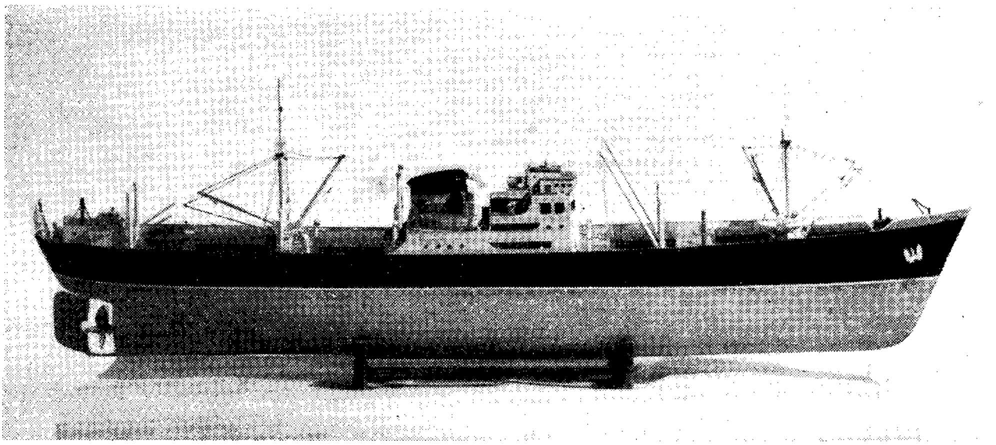
Ship Models

in the Competition Section

AMONG the competition models in the Sailing Ship Section we notice a model of the British clipper *Loch Torrens.* The entry form states that the original ship was built in Scotland and that the model was made from instructions contained in a book on ship modelling. We believe that we are correct in saying that the author distinctly states in his book that his design is of a typical four-mast barque (not a clipper ship) of the period, and that the name *Loch Torrens* is fictitious. We all know the famous ship *Torrens,* and also the Loch Line of sailing ships, but so far as we are aware, no sailing ship was ever named *Loch Torrens.*

Mr. W. Nutt, of Laindon, Essex, has entered an interesting series of models of canal barges. One, a steel swim barge, is to a scale of 4 mm. to 1 ft. (is this for an " O " gauge railway layout ?) and three others, of the monkey type, to ¼-in. scale, one a motor barge and the other two towing barges. These barges are noted for their gay colours, the owners vying with each other as to whose barge was the brightest. With the nationalisation of transport and the consequent decline of individualism, there is a danger that this custom will die out, and it is desirable that some records be kept in the form of accurate models.

The showcase model of the Dutch ocean-going salvage tug *Zwarte Zee,* represents a very praiseworthy effort by the model engineering society of Purley County Grammar School, of Old Coulsdon, Surrey. It is a communal effort, and was built under the supervision of the crafts master of the school. It took twelve months to complete and is to be presented to the school for permanent exhibition. A model such as this forms an ideal subject for stimulating the interest and energies of young craftsmen. The idea could be carried on year by year, and by so doing, a very valuable series of models could be made, illustrating, for example, the history and development of the ship, or, alternatively, showing the wide range covered by modern ship design. On the other hand, a model railway system could be made, and additional rolling stock and new features added from year to year. Each successive group of students would strive to improve on the work of its predecessors, and thus a continuous incentive would be provided.



A realistic working model of a modern cargo liner by Mr. C. Knapp, of Leigh-on-Sea

Waterline models offer a good opportunity for showing the ship as she actually appears in sea-going conditions. Two of the entries seem to have taken full advantage of this, one by Ronald V. Shelton, of Dunstable, showing the Hogarth Ship Company's *Baron Elphinstone* lying off an Indian port, and the other showing H.M. destroyer *Cassandra* with her bows blown off, as a result of enemy action during the Russian convoys. This is by D. J. Mills, of Farnham, Surrey. Mr. Anthes' M.V. *Christianholme,* to which reference was made last week, is a model of this pictorial type.

The working model *Vosper,* a motor yacht by A. S. Ablett, of Ruislip, Middx., a photograph of which was reproduced in our last issue, is a very proportionate model, and the detail work in the superstructure has been carried out very well. This class of vessel makes a very good prototype for a model, as the comparatively small

scale is reasonably large, and the details can be represented accurately, provided, of course, that they are not too delicate for handling at the pond side. An ocean-going cabin cruiser, by F. R. Bevan, of Reading; a deep-sea trawler by J. E. Gardner, of Teddington; a Norwegian coaster by J. A. Miskin, of Charlton; a coastal cruiser by J. A. Potten, of Twickenham; a R.N. picket boat by F. F. Woodruff, of Dunstable; and an ocean-going steam tug by Dr. F. Machanik, of Liverpool, are all excellently chosen as to their prototypes, and illustrate the tendency which seems to be prevalent in these days to make working models of smaller types of ships. As a result, we have more robust and better proportioned models and a greater degree of realism in the details. The cabin cruiser *Vanator IV*, by D. E. Lovett, of Morden, also comes into this category, with the additional refinement that it is radio-controlled. Radio control is making slow but steady progress, and owing to its obvious advantages where model steamers are concerned, and to the continual development in radio technique, there is no question but that it will be increasingly applied.

There are a number of miniatures, among them being the model of T.S.S. *Canton* by J. L. Bowen, of London, E.12, and that of the Brocklebank steamer *Marwarri* by F. J. Greenham, of Bristol, both to the scale of 100 ft. to 1 in. Another is a model Thames sailing barge by M. E. Moon, of Holloway, N.7. Remembering Mr. Moon's delightful miniatures of Arctic exploration ships in previous Exhibitions we confidently expect to see a good model.

Before concluding, we must make mention of what we feel is one of the best models in the Exhibition. We refer to the model of the clipper *Thermopylae*, made by Mr. I. W. Marsh, of Barry Dock, South Wales. This was on show in an unfinished state at last year's Exhibition, and from what we saw of it then, we were able to form some idea of what the finished model is like. Mr. Marsh has been working on it for some years, and his work is of a very high standard. He has also been at great pains to find out everything possible about the original ship, so his model is something to claim our careful attention.

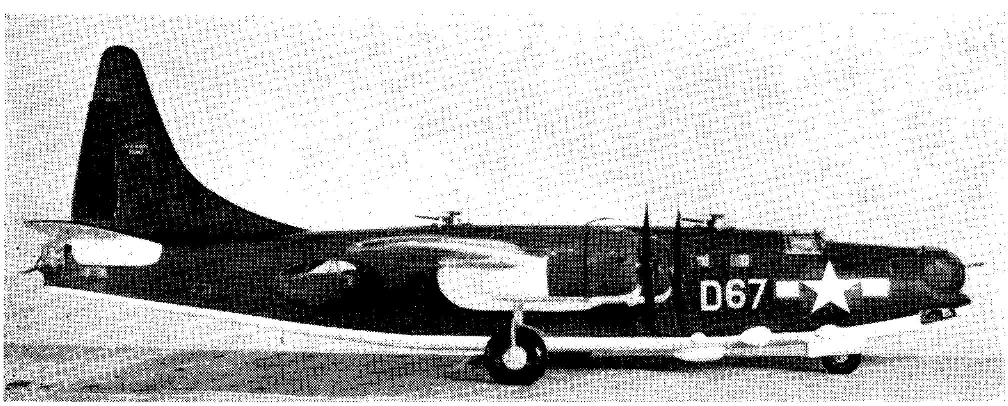
Finally, on view is the model of a merchant vessel of the Levant Company (*circa* 1590), by the well-known marine artist Peter M. Wood, of Kensington, W.8. Mr. Wood knows his period and has actual experience of sailing ships, so his model should be good.

Aircraft Models

THE increased popularity of flying scale models which was apparent at the 1949 "M.E." Exhibition is even more marked this year and a very large majority of the models in the aircraft section are of this type. Certainly this makes the exhibit much more attractive to the general public, to whom a replica of a full-sized aircraft is much more likely to appeal than a purely functional contest-type of model.

Many of this year's model aircraft entries are radio-controlled and one of the most outstanding is a 10 ft. 6 in. wing span model of the Airspeed Ambassador 50-seater airliner. It is powered by two 10-c.c. Ohlsson engines and the radio controls the engine speed, rudder movement, tricycle undercarriage retraction, and the navigation lights. It is a most ambitious and praiseworthy project and reflects great credit on the skill of the entrant, Ronald Ing, of London, N.W.4.

H. J. Towner, of Eastbourne, has been renowned in model aircraft circles for many years for his excellent flying scale models, and his replica of a Bristol Wayfarer is well up to his usual high standard of construction and finish. Built to a scale of 6/10 in. to 1 ft., it represents a really fine example of aircraft modelling.



An outstanding exhibit in the Model Aircraft Section. This American PB4Y-2 Privateer control-line model, entered by E. J. Pithers, of London, W.11, has a wing-span of 7 ft. 9 in.

Another model in this class which is worthy of close inspection is a 4 ft. wing span replica of the German Henschell HS 126. It is fitted with a 1.3-c.c. diesel engine and took its entrant, R. Pearson, of London, W.5, nine months to build, the excellent finish being obtained entirely by hand polishing.

In complete contrast to the models mentioned above is the 9 ft. wing span contest-type model by E. E. U. Rogers, of Weybridge, Surrey, a regular exhibitor who can always be expected to produce something out of the ordinary. This model has been based on present-day American high-performance contest types and is powered by a 10-c.c. glowplug engine. It has proved to have an extremely good flight performance.

Large models always tend to attract most attention and it is easy to overlook the fine work which is often to be seen in the smaller entries. One of these which should not be missed is a 27 in. wing span model of the Fairchild Argus entered by A. J. Longstaffe, of Westcliff-on-Sea, Essex. This model is powered by a tiny 0.2-c.c. diesel engine and weighs only 4¼ oz.; nevertheless, it has a sprung undercarriage and a detailed cabin interior.

Other models in this section which should be seen are a Nieuport Scout by J. J. F. McCarthy, of Westcliff-on-Sea, which has an imitation Le Rhone engine, detailed cockpit and armament, and other true-to-scale features. Also, the Fokker D VIII entered by P. L. Gray, of Luton, Beds, which exhibits very neat construction and finish.

In the control-line section there are many excellent examples of aeromodelling and one entry is from a lady, Mrs. D. Sharpe, of Whyteleaf, Surrey. This is a 33-in. wing span stunt biplane named *Yoicks* and is powered by a 10-c.c. racing-type engine.

L. E. Sharp, of Feltham, Middlesex, a previous winner in this class, has entered his latest flying scale control-line model *Miss Los Angeles.* Fitted with a 3.25-c.c. glowplug engine it is noteworthy for its excellent detail construction and superb finish.

E. J. Pithers, of London, W.11, has two very fine entries; the first a Bristol Fighter Type F2B of 4 ft. 8 in. wing span and the second a replica of the American PB4Y-2 Privateer Bomber. This interesting model has a wing span of 7 ft. 9 in. and is powered by four Ohlsson "29" engines. The detail work is particularly commendable and this exhibit has a most realistic appearance.

On the whole the exhibits in the Model Aircraft Section this year are of a very high standard and form a very attractive and interesting display.

Trade Exhibits at the Exhibition

TO supplement our recent notes on what to see on the trade stands, we give below information concerning goods displayed by other trade exhibitors.

F. Atkinson & Co., 14, Aldwarke Road, Parkgate, nr. Rotherham, Yorks. The "E.A.M." power unit displayed by this firm embodies a 47-c.c. flat-top piston two-stroke engine, with a chain-driven countershaft and clutch, adapted to fit the frame of an ordinary cycle and drive the rear wheel by a second chain. In the transmission and method of installation, this unit differs from most of the engines for fitting to cycles which are popular at present, and conforms to principles which are practically universal in motor-cycle practice. The unit has been designed specially for amateur construction, and all castings and materials are available, together with a set of six blueprints; the carburettor specified is the Amal 308, and ignition is by means of the Wico "Bantamag" flywheel magneto.

Craftsmanship Models Ltd., Norfolk Road Works, Ipswich. This firm's display includes samples of the very wide range of castings for model i.c. engines and other types of models, which have been their speciality for several years. Their claim to cater for those interested in "unusual models" is backed up by the fact that, in many cases, the designs are unique, and castings for building them are obtainable from no other source.

This applies to the "Seal" and "Seal Major" four-cylinder engines (the only examples of multi-cylinder engine castings available in this country), also the "Craftsman Twin" two-stroke petrol engine and the "Ladybird" 2½-c.c. compression-ignition engine. All these designs have been fully described in THE MODEL ENGINEER, and are of proved merit. Among new features in this line are castings for the "Seagull" 10-c.c. water-cooled twin engine now being described in THE MODEL ENGINEER, and an entirely new design for a 50-c.c. two-stroke of a type suitable for attachment to a cycle or other utility purposes.

For locomotive constructors, the special attraction is the South African Railways 15F 4-8-2 locomotive, one of the most powerful engines designed to run on 3½-in. gauge track,

and a faithful reproduction of the prototype, both in appearance and mechanical details.

David Curwen Ltd., of Baydon, Wilts, are kindly loaning two exhibits of great interest to lovers of steam. One is a Stanley 20 h.p. steam car engine as fitted to one of their earlier cars, and is, therefore, of considerable historical value; the other is a vee-twin engine designed by two engineers, Bower and Bell, and built in 1948. It is of about 12-15 h.p., fitted with piston-valves and is of modern design throughout. It was constructed by David Curwen Ltd. for M.L. Engineering Co., Slough, to designs and castings supplied by M.L. & Co.

F. W. Kubach, 12, Sylvan Road, Upper Norwood, London, S.E.19. The small machine tools exhibited by this firm include the "Adept" hand bench shapers, the Super Adept lathe, and the "Sylvan" planer-shaper. Both the first-mentioned machines are well known to model engineers, and call for no special comment. A range of accessories is now available for the "Super Adept" lathe, including a two-speed foot motor or power countershaft, a 2¼-in. four-jaw independent chuck and a three-jaw dog chuck. The "Sylvan" planer-shaper has a longer stroke and a greater area of table surface than any other machine of comparable size and type. It is provided with automatic traversing feed, and the tool slide can travel beyond the maximum span of the uprights in either direction. The toolpost is mounted on a swivelling slide which allows of adjustment for angular cutting within a wide range.

Larco Model Supplies, 95, Northcote Road, New Malden, Surrey, have a stand displaying their "OO" gauge pannier tank locomotive, automatic signals, point motion and accessories; "O" gauge fittings and equipment, as well as a *Golden Hind* kit and a comprehensive range of fittings for galleons.

Perfecto, 60, Stanley Street, Leicester. Two machine tools of interest to model engineers are featured in this exhibit. The first is the "Perfecto" sensitive bench drill, having three spindle speeds, and a drilling capacity from 0 in. to ⅜ in., with a spindle traverse of 2 in. Provision is made for adjusting belt tension and alignment, and the spindle feed is by rack and pinion. The swinging drill table is 6 in. dia. with a rise and fall of 9 in. and can be swung out of the way to accommodate large work resting on the baseplate, giving a maximum distance of 12½ in. under spindle.

The second machine is the "Perfecto" 5 in. hand bench shaper, which has a maximum cross traverse of 10 in. and a vertical traverse of 2¼ in. Full swivelling adjustment of the tool slide is provided, and the ram is operated by a rack and quadrant. The table is 6 in. long by 8 in. wide, and has six slots in the top face for attachment of work, machine vice or other fixtures.

Closing a mould containing four "Doris" wheels. (William Waugh)

J. F. Stringer, Express Works, Orleston Road, London, N.7. The "E.W." convertible lathe which has been reviewed in THE MODEL ENGINEER, is shown in this exhibit. It consists of a small lathe of robust and basically simple design, which may be embellished by the addition of attachments, such as back gearing and screw-cutting equipment. In its basic form, the lathe is relatively inexpensive and forms a practical nucleus for the workshop equipment of the beginner whose financial resources are limited; and the extra accessories can be added, also quite inexpensively, as occasion requires and means permit. This method of building up workshop equipment from simple beginnings is one which has often been discussed in model engineering circles, and many will welcome this effort to put the idea into practice.

R. Wills (Scientific Hobbies), 92a, Brighton Road, Coulsdon, Surrey. The speciality of this firm is the Kennedy patent bogie in "OO" gauge, for L.M.S., S.R., G.W.R. and L.N.E.R. rolling stock, also high capacity diamond frame, 16.5 or 18 mm. gauge. These bogies have improved methods of springing, with twin torsion bars giving perfect equalisation, and are accurately made to M.E.T.A. standards.

William Waugh, 31, Hillfort Drive, Bearsden, nr. Glasgow. Specimens of the "Wilwau" range of castings, as advertised in THE MODEL ENGINEER are featured in this exhibit.

IN THE WORKSHOP

by "Duplex"

No. 69—*Making the Kennedy Bending Machine

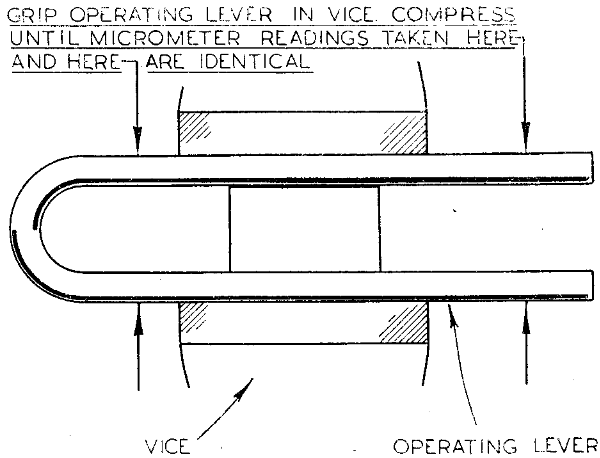


Fig. 1. Method of measuring the operating lever to determine the centres for boring the $\frac{3}{8}$ in. holes in the bending head

IN the previous article the methods used for making most of the major parts of the Kennedy Bending Machine were described.

One further large component now remains to be made, namely the sliding stud *D*; the details of this part are shown in Fig. 1A.

Making the Sliding Stud *D*

Operation 1. In this operation the $\frac{5}{8}$ in. dia. spigot is machined for a length of $1\frac{5}{16}$ in. to accommodate the bending roller *J*. The piece of bright mild-steel bar supplied is gripped in the four-jaw chuck, and set to run truly. The part is then turned to a good finish with a right-hand knife tool mounted in the top-slide. A slight modification has been introduced in this component; instead of the split-pin, which is called for in the maker's drawings to keep the bending roller in place, a knurled head screw *K* has been fitted. This necessitates drilling and tapping a $\frac{1}{4}$ in. hole axially in the $\frac{5}{8}$ in. dia. spigot, and this hole may conveniently be made $\frac{1}{4}$ in. B.S.F.

Operation 2. The work is now removed to the drilling machine so that the two $\frac{3}{8}$ in. dia. holes to receive the lever *G* may be drilled. Accordingly, the sliding stud is set in the machine vice after marking a centre-line for the first $\frac{3}{8}$ in. dia. hole $1\frac{3}{16}$ in. from the upper end of the component.

**Continued from page* 161, "*M.E.*," *July* 27, 1950.

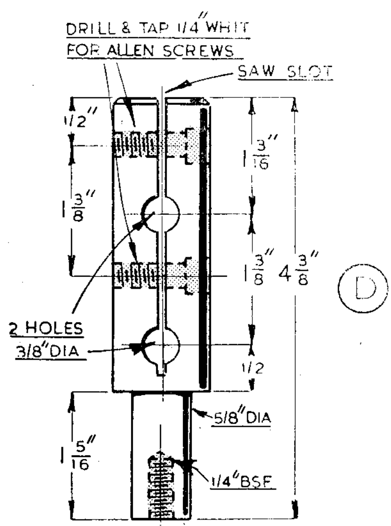


Fig.* 1A. *Details of the sliding stud D

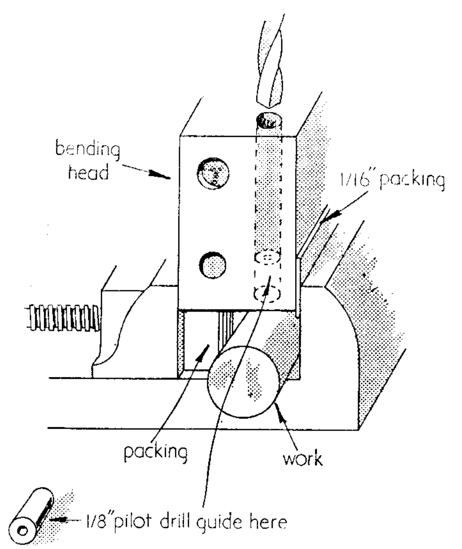


Fig. 2. ***Setting up the sliding stud for drilling***

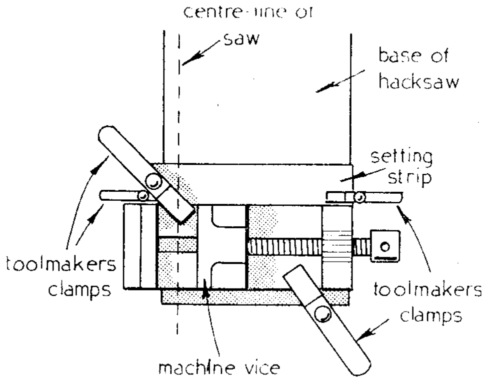


Fig. 3. Setting the vice for sawing the sliding stud in the machine saw

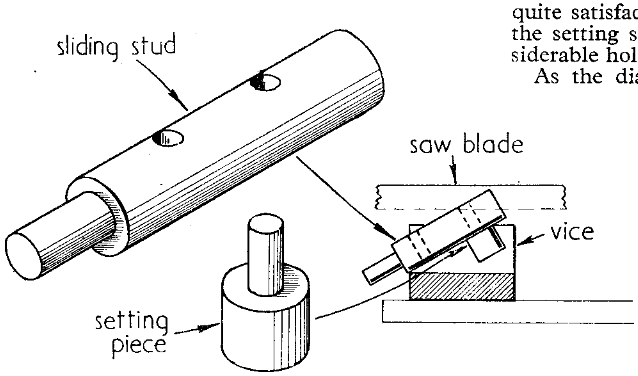
The bending head is now placed over the stud to act as a drilling jig, and is packed out with a piece of $\frac{1}{16}$ in. material to align the centre of the drilled holes in the bending head with the centre-line of the stud. To position the bending head, the centre-line previously scribed on the work $1\frac{3}{16}$ in. from its upper end is sighted through the appropriate $\frac{3}{8}$ in. dia. hole in the head. In order to hold the work firmly against the standing jaw of the vice, packing is inserted between the moving jaw and the work, as shown in Fig. 2. The work may then be drilled. It is advisable in the first instance, however, to pilot the holes, and this may be conveniently carried out by using a short length of $\frac{3}{8}$ in. dia. round material in which a $\frac{1}{8}$ in. hole has been drilled axially. The simple jig, which is made an easy fit in the $\frac{3}{8}$ in. dia. holes, is dropped into them to act as a guide for a $\frac{1}{8}$-in. dia. pilot drill. This piloting guide and its location may be seen in Fig. 2. It is scarcely necessary to ream the $\frac{3}{8}$ in. holes in the sliding stud, for the close guidance afforded to the drill by the bending block will ensure that the lever *G* is a sufficiently good fit in the drilled holes.

Operation 3. The slot which runs axially down the component must now be sawn. When facilities for milling are available this method will no doubt be employed, but the work can be conveniently carried out in a power hacksaw. The more so if the machine is of a type, shortly to be described, which permits a great variety of work to be mounted upon the machine table. If neither of these methods can be used, the slot will have to be made with a hand hacksaw, but, it must be confessed, this will be a tedious operation and the chances of producing a good finish are doubtful.

Cutting the Slot

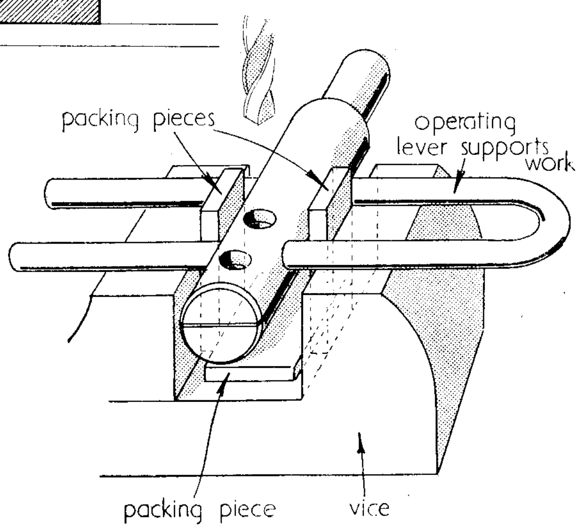
To use the power hacksaw for cutting the slot, a machine vice must be fixed down so that its jaws lie parallel to the axis of the saw blade. In order to ensure that this is so, a parallel strip, such as a narrow rule, is interposed between the standing jaw of the vice and the saw blade itself ; the alignment of the vice is then adjusted. The vice is now clamped firmly in position while a setting strip, made from a piece of 1-in. × $\frac{1}{4}$-in. bright mild-steel, is fastened to the machine table to allow the vice to be moved endways while being maintained at right-angles to the axis of the saw blade. By this means it will be possible to set the work centrally under the saw without danger of misalignment taking place. The arrangement is shown diagrammatically in Fig. 3. In passing, it should be noted that toolmakers' clamps are quite satisfactory for securing both the vice and the setting strip ; this form of clamp has considerable holding power.

As the diameter of the sliding stud is 1 in.,



Left—Fig. 4. Method of aligning the sliding stud in the vice

Below—Fig. 5. Drilling the two $\frac{1}{4}$ in. holes in the sliding stud



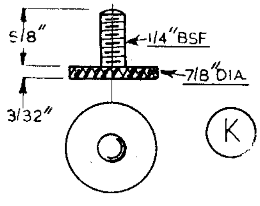


Fig. 6. Details of the knurled screw K

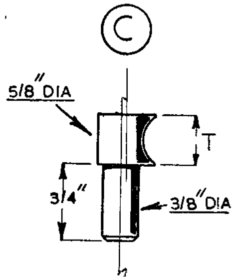


Fig. 7. Details of Stop C

it follows that the centre of the saw blade must be $\frac{1}{2}$ in. away from the standing jaw of the vice. This is best checked by gripping a piece of 1 in. material in the vice and measuring the position of the blade from each jaw in turn, allowance being made for the thickness of the blade.

When the position of the saw has been determined the vice is finally clamped to the machine.

The work is set in the machine vice at an angle, and held in such a way that the saw cut passes through the centre of the two $\frac{3}{8}$ in. holes through which the arms of the operating lever pass. This condition can easily be ensured by fitting to the sliding stud a piece of 1 in. dia. round material having one end turned down to $\frac{3}{8}$ in. dia. to engage the uppermost $\frac{3}{8}$ in. hole, as seen in Fig. 4. This piece of metal then forms a tongue to align the work and also, when gripped in the vice, allows the work to be held firmly at an angle.

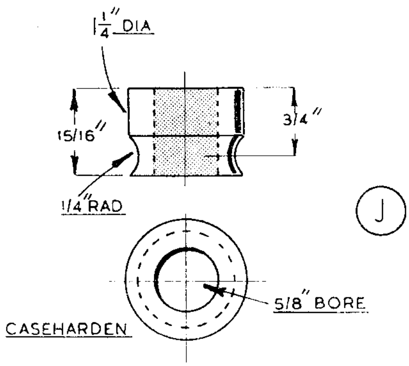


Fig. 8. Details of the bending roller J

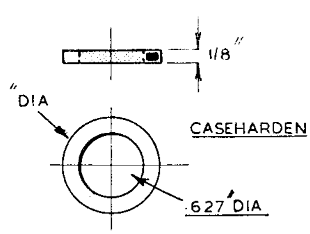


Fig. 9. Details of hardened collar for screwed mandrel B

After the work has been correctly set, the machine is started, and sawing is continued until the slot extends to $\frac{1}{8}$ in. from the bottom of the stud. The work must then be reversed in the vice to allow the saw to remove any unsawn metal from the opposite side of the component.

Operation 4. After the sawing operation, the two $\frac{1}{4}$-in. Whit. holes to receive the Allen screws supplied for clamping the stud to the operating lever must be drilled and tapped. As will be seen in Fig. 5, this can be done most conveniently by passing the operating lever through the stud, and by supporting the latter on the vice. Suitable packings must be placed in the vice to extend the jaws and allow the work to be clamped. Though not shown in the illustration, it is advisable to place further packing under the sliding stud to prevent its lower half deflecting when drill pressure is applied.

The marking-off before drilling is best carried out with a keyseat rule.

After drilling the holes, they must be enlarged for a depth of $\frac{1}{4}$ in. to accommodate the heads of the Allen screws. A $\frac{3}{8}$ in. dia. drill is quite satisfactory for this purpose.

The holes are then tapped, thus completing the making of the sliding stud.

Making the knurled screw *K* is a straightforward machine operation which does not require any special comment. The knurling should be carried out neatly, and full instructions on this subject have been given in these articles in the past. All details necessary for making the knurled screw are given in Fig. 6.

In order to complete the machining of the Kennedy bending device, three small parts remain to be made. These are the stop *C*, the bending roller *J*, and the hardened collar which fits under the screwed mandrel *B*. Details of these three components are given in Figs. 7, 8 and

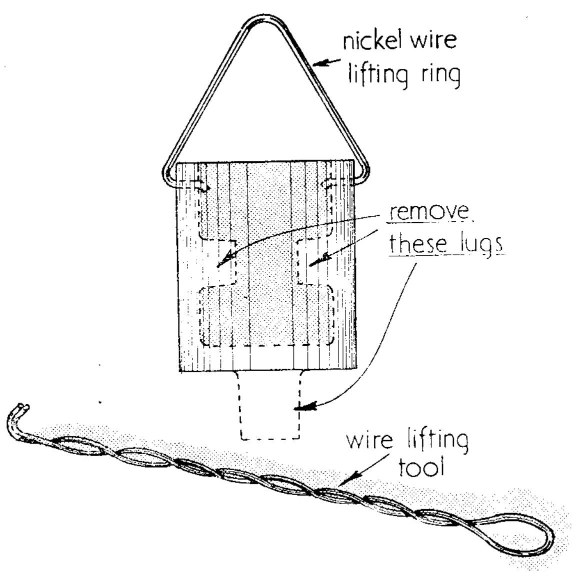


Fig. 10. A hardening pot made from an iron piston casting

9 respectively, and the work upon them is of an elementary nature calling for no detailed comment.

The roller *J* and the hardened collar both need to be case-hardened after machining. The bores of both components should therefore be made 0.001 in. to 0.002 in. oversize to allow for possible shrinkage.

The case-hardening may, with advantage, be carried out by soaking the parts in a bath of molten "Antol," a proprietary compound sold by Messrs. Pidgen Bros., of Helmet Row, London, E.C.

This compound, which is in powder form, is melted in a suitable container, which must be large enough to ensure that the parts are completely covered by the molten liquid. Complete immersion ensures that all air is excluded from the work-pieces; thus no oxidation can take place and no scale can form on the surface of the parts. After quenching in water, the work presents a mottled or grey appearance and can be polished readily if required.

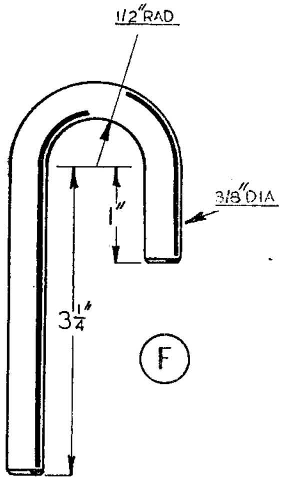


Fig. 11. Details of the plunger F

A suitable container for a few hardening operations is an old glue-pot; but, for repeated use, a heavy pot, such as can be made from an iron piston casting, is essential for the hardening compound is somewhat destructive. The method of making a pot from a piston casting is shown in Fig. 10, and it will be seen that, as indicated by the dotted lines, the gudgeon-pin lugs have been removed. The pot is fitted with a wire loop to enable it to be withdrawn from the furnace. On no account must iron wire be used for this purpose, for it will quickly burn away. Instead, a loop of heavy gauge nickel wire must be fitted. It is sometimes possible to obtain the necessary material from broken-down electrical resistance units designed for carrying large currents.

The parts to be hardened are packed into the pot, covered with the hardening compound, and the pot and its contents are then lowered into some convenient furnace, such as an independent household boiler. The contents of the pot are observed from time to time to see if the compound has melted, which it will do at a medium red-heat, and any shortage of the "Antol" is then made up to make certain that the parts are completely covered.

Depth of Casing

The work is allowed to soak in the molten liquid for from a half to one hour according to the depth of case required, and is then removed so that the parts can be plunged in cold water individually. If the depth of casing is important, it is a good plan to put into the hardening pot, together with the parts which require hardening, some test-pieces of metal having the same specification as the parts. These test-pieces can then be withdrawn, plunged in cold water, and broken in the bench vice so that the depth of case-hardening can be seen.

It is a simple matter to load a cold pot with parts, but it is quite another affair to pick them out of the container when red-hot. Accordingly, the tool seen in the illustration must be provided. This tool, which is made from twisted iron wire, can then be hooked into parts which have holes formed in them or are otherwise convenient to handle by this means. Small parts are best wired together, and any components which have neither protuberances nor holes into which the tool can be hooked should be served with a wire loop to facilitate withdrawal. Here, again, it is best to use light gauge resistance wire, for this will withstand the high temperatures and will not corrode.

Assembling the Bending Machine

Apart from a few simple drilling operations, no further machine work on the bending machine is required. The parts may, therefore, be assembled. The hardened collar is placed over the tail of the screwed mandrel *B*, which is then pressed into the base *A*. Two holes are then drilled and tapped axially in both the mandrel and the base, to accommodate a pair of $\frac{1}{4}$-in. Whit. hex-headed screws which, supplied with the kit of parts for this purpose, serve to lock the screwed mandrel in place. The stop *C* is placed in an appropriate hole in the base *B*, completing the assembly of this part of the work.

The plunger *F* and the operating lever *G*, details of which are shown in Figs. 11 and 12, are both provided ready made, and only need to be cleaned up ready for assembly. In the operating lever, however, two dimples must be made to allow the Allen screws fitted in the bending head to seat themselves. The forming of these dimples may be carried out conveniently by using the bending head, once again, to guide the drill.

Accordingly, a line is marked on one of the arms of the lever, $\frac{13}{16}$ in. from its end. The lever is then passed into the bending head and the scribed line is sighted through the appropriate tapped hole. A 13/64-in. drill may then be used to make the necessary dimples.

When this has been done, the sliding stud may be slipped over the lever which, together with the plunger *F*, is inserted into the bending head. The latter is then placed on the screwed mandrel and the machine is complete.

Bending Formers

The bending formers are made specially to suit the work in hand. As will have been seen in the illustrations, formers to enable pipe to be bent are discs having a 1 in. hole bored through the centre to allow the former to be passed over the screwed mandrel. The edge of these discs, which have a thickness of 1/64 in. less than the pipe diameter, are given a curvature to conform with that of the

pipe itself. The diameter of the former will depend upon the radius of the curve to which the pipe is to be bent. A typical former, together with the stop *C* set in its optimum position, is shown in Fig. 13.

It will be clear that, in order to allow the setting shown in the illustration to be carried out, stops with varying head offsets will have to be made to accommodate work of different sizes in conformity with the bending radius.

After the appropriate former has been placed over the screwed mandrel, the work is put in the machine, resting against the stop *C*. The top plate *E* is then brought into contact with the work. The sliding stud is adjusted for position to give the maximum leverage and the operating lever is then pulled round till the desired bend has been obtained.

When bending mild-steel, and in particular when forming curves with the material on edge,

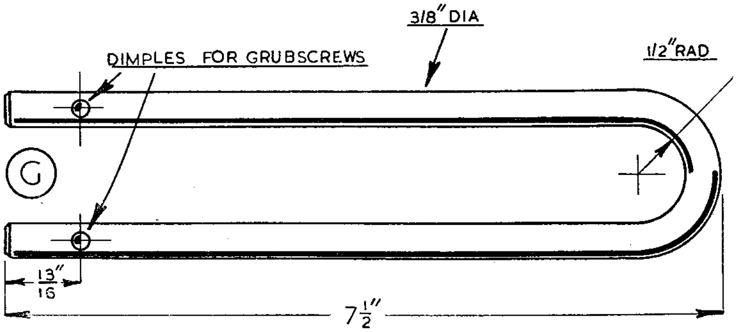


Fig. 12. *Details of operating lever G*

Formers for material which is to be bent on edge or for square sectioned work are plain discs having no machining on their edges, but for complex work such as angles and irregular sectioned materials, the correct profile is a matter about which Messrs. Kennedy should be consulted, for they have all the information on the subject and will be glad to give advice which will enable satisfactory results to be obtained.

As bending formers have to be machined on their edges as well as in the bore, the simplest, in fact, the only, way to carry out the necessary machining properly is to bore the blanks which have previously been faced, and then to mount them on a true running stub mandrel so that the periphery can be machined, either with a form tool, or in any other way which will produce the required shape. In giving this advice it is assumed that, as in the case of the particular kit of parts which was used to build the bending machine under description, the material for the formers will be supplied ready sawn to length.

it may be found that some grades of metal are tough and do not yield readily. In those circumstances the work should be removed from the

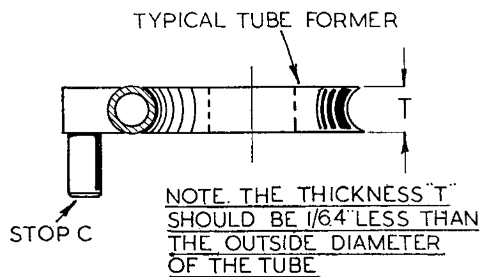


Fig. 13. *Showing position of stop and former for tube bending*

machine and the metal should be annealed, by heating to a dull red-heat and allowing it to cool, before any further attempt at bending the material is made.

Using the Bending Machine

In order to use the machine to its best advantage it is essential that it should be firmly mounted. Probably the most convenient way to do this is to bolt the machine to a piece of 2-in. square hardwood, which is then gripped in the bench vice. This arrangement allows the machine to be packed away when not in use ; at the same time the tool can be brought into operation with the minimum of delay.

The only limitation to this practice is, of course, the mounting of the vice itself. However, if this is firmly carried out, as it should be, there will be no danger of the vice mounting giving way.

A Reminder—on Files

When many brass, iron and steel parts require filing, the newer files should be used on the brass parts. We are prompted to print this reminder because we were lately visiting a workshop where two men were engaged on filing operations, one on some small brass castings and the other on some steel bar ; we noticed that they frequently exchanged files, since both were bent on producing a fairly high degree of finish. If each had his own set of files, the brass worker having the newer set, those files would give longer service. Economy is *still* worth some consideration !

"L.B.S.C.'s" Beginners' Corner

Alternative Boiler for "Tich"

SECOND thoughts are best, says the old saw. Just as I was going to start in to describe the first brazing job on the boiler for *Tich*, it occurred to me that as I had already promised to give details of an alternative larger boiler, for those who preferred a larger size in kettles, the obvious thing to do, to save precious time and space, was to give the drawing of the larger boiler right away. As the *modus operandi* is exactly the same for either boiler, one description of how to do the job, would cover them both; builders simply work to the sizes given for the boiler of their choice, using the same methods. To enable our beginner friends to make an easy decision, I have drawn out the engine complete with a bigger boiler, so that you can see how it looks. By way of variation, I have altered some of the details; but please note that these can be used for either boiler, larger or smaller. Contrariwise, as Mary would remark, you can use the original fittings and mountings for either job, just as you fancy. It is said that variety is the spice of life—so there must have been an abundance of "spice" on the L.B. & S.C.R. in the days of John Chester Craven. Unofficial history tells us that the principal language spoken, was railroad Esperanto —and history has certainly repeated itself during the last few years in the same locality. Did I hear somebody quote "and there shall arise in our midst, a Leader"?

Bigger Around the Waist

The alternative boiler is exactly the same length as far as barrel and firebox are concerned, and the grate area is only increased by a small amount, due to extra width; but there is more heating surface, due to the firebox being wider at the top, and allowing more tubes to be put in. This boiler is a little bigger than that on my old 2-2-2 *Ancient Lights*, and I have already recorded how that one steams, so nobody need have any fear of this one not doing the job, provided that the instructions are followed. When on the rare occasions I hear of one of my specified boilers failing to steam, I am always suspicious of the workmanship, or inattention to details. One, or more usually both, are invariably responsible. Badly-made cylinders and motion also waste steam.

The barrel is ½ in. larger in diameter than the original, and contains nine ⅜ in. tubes, and one ⅝ in. superheater flue. The smokebox is circular, and slightly extended; it is mounted on a saddle, and bears a resemblance to the Brighton "Terriers" after they were rebuilt, so I thought we might see what a chimney of the pattern fitted to these famous engines, would look like on this job. Personally I prefer the shape shown here, to the original *Tich* chimney, but naturally I am prejudiced. As some beginners might fight shy of fitting a working spring-balance safety valve, I have substituted an ordinary direct-spring valve, mounted on top of a squat inner dome. The outer casing of the dome is of the usual pattern, but on top of it are two small replicas of the safety valves specified by Dugald Drummond for the L.S.W.R. and other engines. They have no valves fitted, but are drilled straight through. Steam escaping from the valve inside the dome, blows through them with a very realistic roar. It did on my 2½-in. gauge *Southern Maid*, anyway. A plain dome could, of course, be used, with a single safety-valve in a casing of any desired shape, or without any casing at all, just in front of the cab; but the boiler being so short, the top of it would look terribly crowded with a separate safety-valve. The short cab is also just an alternative suggestion; if you prefer the original plain weatherboard, why, just put it on, and that's that. The superheater, backhead fittings and so on, will be the same for either size of boiler.

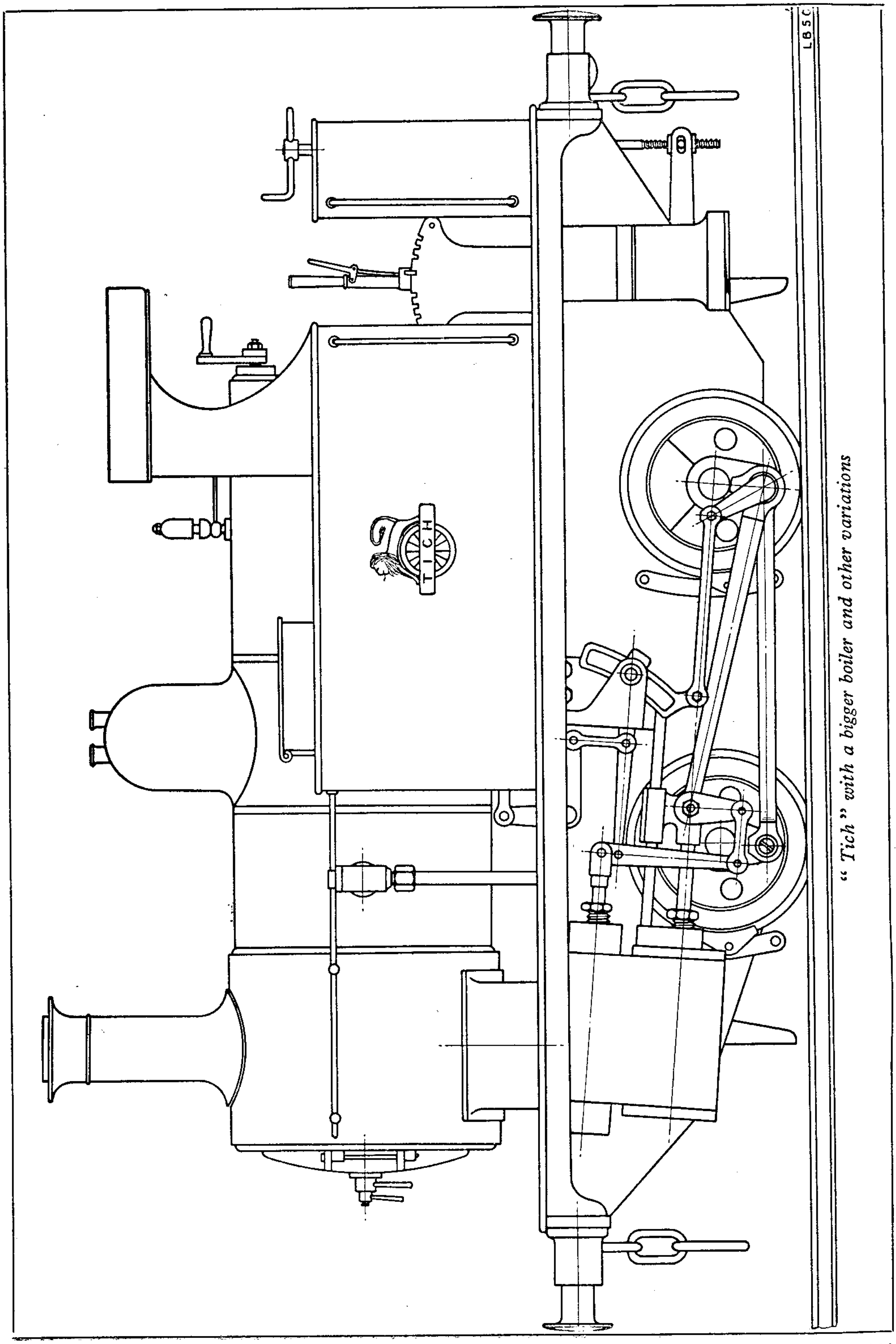
Slight Variations in Detail

For this boiler, a piece of 18-gauge sheet copper measuring 10 in. by 7 in. will be needed. At 3 in. from one long edge, make two cuts with the snips, 2⅛ in. long, similar to the smaller boiler; then from the opposite long edge, cut a ⅛ in. strip off each end, as far as the cuts. After that, carry on exactly the same as described for the 2½ in. diameter boiler, bending the whole lot first to the outline shown in the cross-section, and then continuing with the 4-in. portion until you have formed a complete circle 3 in. outside diameter, the overlap being approximately ¼ in. Put a few rivets in it, to hold it until brazed, same as the little one. See that the overlapping edges are quite clean; very important, that.

The throatplate needs a piece of 16-gauge copper sheet 3⅛ in. by 2¼ in. If the metal appears to be hard, anneal it by heating to medium red and plunging it into cold water. The sides can be bent over in the bench vice, to form the flanges, same as the smaller one; then put the plate temporarily in position, and putting a scriber down inside the barrel, scribe the radius shown. Cut out the piece as described previously; you will find there is a little tag left at the top of each side flange, so bend this outward, to suit the curve of the boiler shell. The throatplate is then put in place, and riveted with a few $\frac{1}{16}$-in. round-head copper rivets, to hold the parts together, in close contact, whilst the brazing operation is performed. All being well, I'll tell you how to do that in the next instalment of the *Tich* serial.

How to Set "Pamela's" Valves

If the valve-gear for *Pamela* has been made and erected according to specification, there is little



"Tich" with a bigger boiler and other variations

Streatham Junction North, and just past Norbury. The slightly heavier blast going up the grade, brought the fire to full incandescence, and both pumps went on, and the fire-hole door had to be carefully manipulated, so she didn't waste steam at the safety-valves. The enginemen were encouraged in those days, to get most work for least steam, by a cash payment for all the coal they saved over the standard allowance. This was 17 lb. per mile for the engine, and an extra $1\frac{1}{4}$ lb. for every two axles in the train; the premium was one penny per cwt. saved, and it was no uncommon thing for a driver and fireman to share 30s. per month. 30s. WERE 30s. in those days, when the top-link men were paid 8s. per day, a pint of "wallop" cost 2d., and cigarettes were five a penny. In the vicinity of the locomotive sheds in the London area, driver's wives would provide really good board and lodging for cleaner boys, for—hold your breath—5s. 6d. per week; and both the boys and the wives were well satisfied. Things are different now!

After passing Selhurst, the engine, having now shaken the dust of the suburban area off her wheel spokes, would gather her skirt and set about the job in deadly earnest. The fire was now really hot, and she would take full advantage of the little dip down to Windmill Bridge, to gather speed for rushing the 1-in-264 through East Croydon, right up to Merstham Tunnel. The driver would know the exact point of cut-off, to enable her to sustain her speed up the grade; and with a joyous call from the deep-toned whistle, she would buzz through the busy station and set her back into it. Both pumps would be on again, the firehole door open a little, and part of the exhaust steam going back into the tender, to warm the feedwater. The hot feed was one reason why old man Billy's engines were so economical. There was a butterfly-valve in the return exhaust pipe just ahead of the drag beam, but I never heard of anybody ever shutting it; in fact, I don't believe half of the enginemen knew it was there!

Once through the tunnel, the fur would fly with a vengeance. The old girl would take the bit between her teeth and go tearing like mad down through Redhill and Earlswood; the driver would always let her have her own way. The fire would die down a little, the damper could be dropped a notch or so, and one pump would put in more water than she would need. There were a few unrecorded speed records made both in this section, and on the slightly longer one further along. The impetus gained here, would take her well up the next rise, through Three Bridges, and the grade would be almost surmounted before the blast became strong enough to pull the fire back to a full incandescence again. It would by now be burning down a bit, and maybe if the coal was of a certain kind, inclined to cake. After passing the summit at Balcombe Tunnel signal-box, away she would go again, up in the eighties, on hardly any steam; through Balcombe Station, across Ouse Viaduct, down through Copyhold, and Haywards Heath, gathering energy for rushing the last bit from Wivelsfield to Clayton Tunnel. Just before hitting the grade, the fireman would take a look in the box, and if the fire had not burned down evenly, he would give it a prod or two with the pricker. We always fired "saucerwise," that is, around the sides and back of the box, so that the fire was thinnest in the middle, and sloped down from the firehole door to the tubeplate. The prodding would loosen up the fire, and as the pricker was always pushed underneath, so as to lift the fire, any ash that had accumulated, would fall through the bars; and the slightly heavier pull up to Clayton Tunnel would pull the remains of the fire up almost to white heat again, keeping the gauge needle where it belonged. The rest was just a "bit of cake," both for engine and crew. She would practically coast the 5 miles from the tunnel, through Patcham and Preston Park, to the terminal station at Brighton; and all that remained as she drifted home, was to fill up the boiler and let steam down to about 100 lb. so that the engine would stand quiet under the station roof until the station pilot (shunting engine) pulled the empty coaches out, and left her free to go to the sheds. She would finally come to rest, close to the buffer stops, with a couple of inches of dull embers on the bars, having done the 50 odd miles at a good clip, on the bit of coal the fireman put in when leaving Victoria. Including what was in the box before he fired her, the total amount burnt, was around half-a-ton.

It is interesting to note that my $3\frac{1}{2}$ in. gauge version of the same type of engine, will do the exact equivalent of the same job in the same economical fashion; but by virtue of superheating, mechanical lubrication, and my own variation of ports, valves, valve-gear and setting, she will do it hauling an equivalent of $2\frac{1}{2}$ times the load hauled by her big sisters.

After that little excursion into the past, all that remains to be added, is that when you get a hiss of air from *Pamela's* cylinder cocks exactly as the crank arrives on each dead centre, when turning the wheels by hand in either direction, with the lever in mid-gear, the valves are correctly set, and that is all you need worry about. The valve-gear will attend to the rest of the business. Next, we have to see about a means of supplying the cylinders with steam instead of air.

Locomotive Trials

On Sunday, August 27th, the South London Model Engineering Society will hold their fifth annual locomotive trials. These will take place at Dog Kennel Hill, East Dulwich, S.E., and commence at 10.30 a.m.

A hearty invitation is extended to all member clubs of the South Eastern Association and any other club to be our guests and bring their locomotives and compete.

A sit-down tea will be provided and ladies are welcome. Will clubs kindly advise us beforehand of the number in their party coming.

One track will be provided for the trial running and another for running locomotives whose owners do not wish to compete.

Hon. Secretary: W. R. Cook, 103, Engleheart Road, Catford, S.E.6.

Novices' Corner

Allen Screws

READERS will probably have remarked how often Allen screws are specified in the designs published in THE MODEL ENGINEER for the assembly of mechanical parts. Again, inspection of modern small machine tools, or a visit to an engineering exhibition, will show that screws of this form are now largely displacing ordinary screws or bolts and nuts for the erection of machine components.

This is quite understandable on several grounds, for the Allen screw, when fitted, not only has a neat and unobtrusive appearance, but, as it is made of heat-treated nickel-chrome steel of high tensile strength, it is extremely strong. The knurled head of the cap screw shown in Fig. 1 enables the screw to be easily turned with the fingers when, for example, it is fitted to the lathe tool-holder or top-slide turret. For production work, the domed end at the start of the threads ensures that the screw can be started in its hole without waste of time. Again, the small size of the screw-head often saves valuable space where the screw is fitted to, say, a big-end bearing, or is used for bolting down castings.

Perhaps, one of the screw's greatest advantages, when it is used in the small workshop, is that a specially machined bolting face is not required, for spot-face cutters of the right size are not always available when it comes to forming the bolt holes in a casting. Fig. 2A shows a casting secured by an ordinary hexagon-headed screw or bolt; here, as will be seen the screw-head abuts against an irregular, unmachined surface, with the result that the clamping pressure is unevenly distributed, so that if the screw is fully tightened its shank will be bent, and the correct assembly of the parts may be upset. In commercial practice, the hole to receive the Allen screw shown in Fig. 2B would be located by means of a drilling-jig, furnished with a hardened steel guide bush to keep the drill point from being deflected by any irregularities on the surface of the casting.

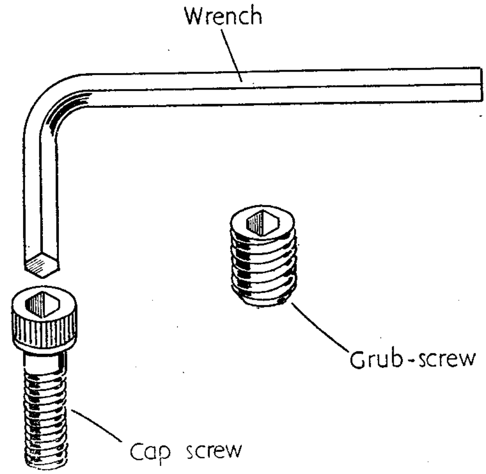


Fig. 1. Two forms of Allen socketed screws

In the small workshop, however, the following method will usually serve to locate the hole correctly. A deep punch mark is made at the marked-out drilling centre, and a small centre drill is first entered up to the full diameter of the body portion. This is followed by a larger centre drill having a body diameter at least equal to that of the screw-head. In this way, the point of the centre drill will act as a pilot in maintaining the conical portion on the true line; finally, the conical recess can be drilled out to receive both the head and the shank of the screw without any danger of the drill running to one side.

As represented in Fig. 3, there are two ways of forming the abutment face for the screw-head at the bottom of the drilled recess. In Fig. 3A, this face is left as formed by the drill point, and this will be found quite satisfactory for work where the parts are not highly stressed or subjected to vibration; but when, for example, fitting the screws securing the cap of a bearing, it is advisable to form a flat seating for the screw-head, as shown in Fig. 3B. This form of seating can readily be machined in the drilling machine by entering an end-mill after the head recess has been drilled as shown in Fig. 3A. The form of wrench used for tightening all types of Allen screws having

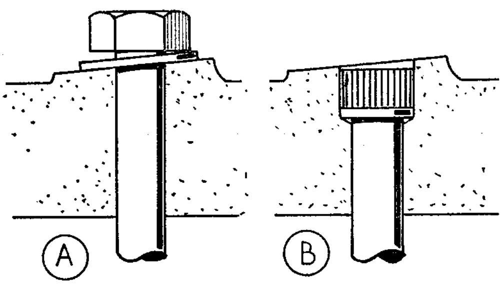


Fig. 2. A hexagon bolt (A) and an Allen screw (B) applied to an irregular surface

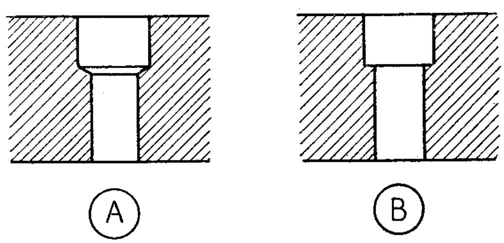


Fig. 3. Showing two forms of recess for the head of a cap screw

socketed heads is shown in Fig. 1, and like the screws themselves, these are made of a high-tensile alloy-steel.

Sets of wrenches of the seven sizes in common use can be obtained mounted in spring clips attached to a key-ring. It is advisable to have a set of these wrenches in the workshop when dismantling and assembling any machine parts fitted with Allen screws, for a makeshift substitute for the proper tool is almost certain to cause trouble. As a case in point, a mechanic was seen to drive the blade of a screwdriver into the socket

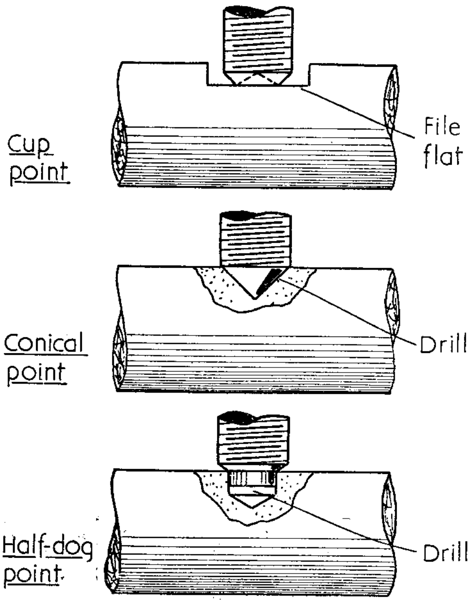


Fig. 4. Shaft seatings for three types of set-screw

of one of these screws, and not only did he fail to shift the screw, but he split the head right across, so that the ultimate removal of the screw was, no doubt, made extremely difficult and time-wasting.

Allen Set-Screws

From their appearance, these are quite commonly referred to as grub-screws. When made in the socketed form shown in the small drawing in Fig. 1, a set-screw can be tightened more firmly with its appropriate wrench than can an ordinary slotted screw with a screwdriver; moreover, there is no danger of the wrench slipping in the screw-head, as so often happens when a screwdriver is used to tighten a small set-screw with a slotted head.

When fitting Allen grub-screws for, say, securing a belt pulley to its shaft, some preparation of the shaft may be found necessary before the parts are assembled. The three patterns of Allen grub-screws in common use are shown in Fig. 4, where the appropriate seatings formed on the shaft are also illustrated. The set-screw with a cup-point will, when firmly tightened, obtain a very secure hold, as the rim of the cup bites into the surface of the shaft; but in so doing, the rim will raise a circular burr on the surface of the metal which may interfere with the easy removal of the pulley. Moreover, if the pulley is made of soft alloy, this burr may cause scoring of the pulley bore when the parts are dismantled.

To overcome this difficulty, it is usual to form a sunk seating for the tip of the screw; this flat may be made longer than the diameter of the screw to allow for adjustment of the pulley's position on the shaft. The second type of screw, that having a conical point, is designed to engage in a dimple or shallow drill hole formed in the shaft. Unless a large area of contact is obtained by machining the shaft recess to the same angle as that of the screw point, it is, perhaps, best to use this form of screw for light duty only. The Allen set-screw having a half-dog point, as represented in the lowest drawing (Fig. 4) may be used for the accurate location of parts attached to a shaft, and the large area of contact will give a secure drive when the fitting is properly carried out. The dog-ends of these screws are machined to an exact fractional inch diameter to facilitate the drilling operation on the shaft. When fitted in the way shown in the drawing, this type of screw forms a small key engaging in a keyway. To increase the security of the drive, two or more set-screws of any of the forms illustrated may be employed, and where two screws are fitted it is customary to space them at right-angles to one another.

When fitting grub-screws, it may be found that a particular screw needs shortening. Some small Allen set-screws will, however, be found too hard to cut with a hacksaw or file, but they can usually be softened by heating to a dull red. Another way of shortening small socketed screws is to grind the tip on the emery wheel; for this purpose, the screw is pushed on to the end of its wrench, which then serves as a convenient handle.

The two types of Allen screws described, the cap screw and the set-screw, are those most commonly used in the small workshop, but many other patterns are obtainable, including socketed screws with countersunk heads, and shouldered screws with accurately ground shanks.

NOTICES

The Editor invites correspondence and original contributions on all small power engineering and electrical subjects. **All such correspondence should be addressed to the Editor (and not to individuals)** at 23, Great Queen Street, London, W.C.2. Matter intended for publication should be clearly written, and should invariably bear the sender's name and address.

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